THE TECHNOLOGY DEMONSTRATION, FINANCIAL PERFORMANCE AND PRODUCT TEST RESULTS FOR SUPERWOOD

JANUARY 1992

Ontario

Environment
Environnement

ISBN 0-7729-9160-X

THE TECHNOLOGY DEMONSTRATION, FINANCIAL PERFORMANCE AND PRODUCT TEST RESULTS FOR SUPERWOOD

Report prepared for:

Waste Management Branch
Ontario Ministry of the Environment

Report prepared by:

Superwood Ontario Limited

JANUARY 1992

Cette publication technique
n'est disponible qu'en anglais.

Copyright: Queen's Printer for Ontario, 1991
This publication may be reproduced for non-commercial purposes
with appropriate attribution.

PIBS 1767

DISCLAIMER

This report was prepared for the Ontario Ministry of the Environment as part of a ministry-funded project. The views and ideas expressed in this report are those of the authors and do not necessarily reflect the views and policies of the Ministry of the Environment, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

TABLE OF CONTENTS

		Page
FINAL REPORT ABSTRACT		i
1.0	INTRODUCTION AND BACKGROUND	1
	1.1 OBJECTIVES OF THE SUPERWOOD PROJECT	2
	1.2 HISTORY OF SUPERWOOD	2
	1.2.1 Corporate Structure	3
2.0	**SUPPLY OF POST-CONSUMER\POST-INDUSTRIAL PLASTICS**	5
	2.1 BLUE BOX COLLECTION PROGRAMME	5
	2.2 THE MUNICIPALITIES SUPPLYING PLASTIC	5
	2.3 INDUSTRIAL/COMMERCIAL/INSTITUTIONAL SUPPLY OF PLASTICS	7
	2.4 WEIGHTS AND VOLUMES OF WASTE DIVERTED FROM LANDFILLING	7
3.0	**THE SUPERWOOD PLASTICS PROCESSING PROCESS**	**8**
	3.1 INSTALLATION AND START-UP COSTS	8
	3.1.1 List of Equipment Used in the Superwood Process	8
	3.2 FEEDSTOCK RECEIVING	10
	3.3 SORTING	10
	3.4 SHREDDING AND MIXING	11
	3.5 BLENDING	12
	3.6 EXTRUSION	12
	3.7 STORAGE AND SHIPPING	13
	3.8 STAFF AND MANAGEMENT REQUIREMENTS	13
4.0	SUPERWOOD PRODUCT EVALUATION PROGRAMME	15
	4.1 DESCRIPTION OF THE EVALUATION PROGRAMME	15

4.2 PRODUCT TEST RESULTS 15
4.3 PROPERTIES OF SUPERWOOD 16
4.4 TEST RESULT VARIATIONS 17
4.5 WATER ABSORPTION 18
4.6 FUNGAL RESISTANCE 19
4.7 BACTERIAL RESISTANCE 19
4.8 DENSITY 19
4.9 ULTRAVIOLET TEST 20
4.10 MECHANICAL TESTS 21
4.11 TENSILE STRENGTH 22
4.12 FLEXURAL MODULUS OF ELASTICITY 22
4.13 NAILHOLDING TEST 23
4.14 PRODUCT PERFORMANCE CONCLUSIONS 24

5.0 ENVIRONMENTAL AND ENERGY ANALYSIS 25
5.1 ENVIRONMENTAL SUSTAINABILITY THROUGH SUPERWOOD 25
5.2 ENERGY SAVINGS REALIZATION THROUGH SUPERWOOD 26

6.0 PRODUCTION RESULTS 29
6.1 QUANTITIES OF MATERIALS PRODUCED 29
6.2 SUPERWOOD PRODUCTS PRODUCED 29
6.3 PRODUCTION PROBLEMS 31

7.0 FINANCIAL ANALYSIS 33
7.1 SALES AND REVENUES 33
7.2 COST OF PRODUCTION 33
7.2.1 Manufacturing Costs 33
7.2.2 Cost of Goods Available for Sale 33
7.2.3 Operating Expenses 34
7.3 BALANCE SHEET 34

7.4 ECONOMIES OF SCALE 34
7.5 CAPITAL INTENSITY AND LEAD TIME TO PAYBACK 35

8.0 MARKETING CHARACTERISTICS 36
8.1 MARKET REVIEW 36
8.2 ORIGINAL MARKETING STRATEGY 38
8.2.1 Marketing Plan Restrictions 38
8.3 COMPARATIVE CHARACTERISTICS AND CUSTOMER EXPECTATIONS 40
8.3.1 Substitute for Pressure Treated Timbers 40
8.3.2 Docks 40
8.3.3 Highway Markers and Signs 41
8.3.4 Municipal Applications 41
8.3.5 Animal Enclosures 42
8.3.6 Pallets 43
8.3.7 Other Uses 43
8.4 FURTURE MARKETING PLANS 44
8.4.1 Markets 45

9.0 CONCLUSIONS AND RECOMMENDATIONS 47
9.1 MEETING THE OBJECTIVES 47
9.2 SUPERWOOD'S POTENTIAL IN CANADA 48
9.3 FUTURE PLANS 48
9.4 RECOMMENDATIONS 49

APPENDICES
A: Terms of Reference 50

TABLE OF CONTENTS

		Page
TABLE		
Table 2.1	Raw Materials Receipt by Municipality	6
Table 3.1	The Timetable from Initiation to Start-up of the Project	8
Table 3.2	Startup Costs: Manufacturing and Processing Equipment for Superwood	9
Table 3.3	Shift Work Schedule for Superwood Ontario	14
Table 3.4	Shift and Management Requirements for Superwood Ontario	14
Table 4.1	Summary of Test Results	18
Table 6.1	A Monthly Summary of Quantities of Superwood Produced	29
Table 6.2	A Summary List of Presently Available Superwood Products	30
Table 6.3	A Product Price Comparison for Superwood and Wood Products	30
Table 8.1	Market Prospects for Various Mixed-Plastic Products	37
Table 8.2	Superwood Market Quantity Projections: Third Year Level	39
		Following Page
FIGURE		
Figure 1.1	Superwood Ontario Limited Organization Chart	4
Figure 3.1	Floor Plan Superwood Ontario	9
Figure 3.2	Main Processing Categories of the Superwood Process	9
Figure 5.1	Estimated Canadian Residential Plastic Waste Generation and Diversion Data (1990)	25
Figure 5.2	Estimated Canadian Institutional/Commercial/Industrial (ICI) Plastic Waste Generation and Diversion Data (1990)	25
Figure 6.1	Superwood Sales and Production 01 August 1990 to 31 July 1991	30
Figure 6.2	A Summary of Products Sold by Superwood for the Period 01 August 1990 to 31 July 1991	30
Figure 7.1	Superwood Ontario: Income Statement	33
Figure 7.2	Superwood Ontario: Balance Sheet	33

ABSTRACT

Superwood Ontario, under the financial assistance of the Ministry of the Environment Waste Management Branch, undertook a project to demonstrate a technology to recycle mixed plastic wastes recovered from the solid waste stream. The overall objective of the project was to demonstrate, using a plastic recycling machine built by Superwood Holdings PLC of Ireland, that a saleable, competitively priced product could be produced from a mixed plastic waste stream obtained primarily from the Mississauga Blue Box curbside recycling programme.

The first twelve months of operation were a learning period. The equipment purchased by Superwood Ontario had never run post-consumer plastic as a steady feedstock. Problems with contamination levels in the feedstock caused extrusion equipment to wear much more quickly than would be expected using virgin plastics. The resultant downtime set back production schedules and caused Superwood to abandon original marketing plans. Superwood compensated for the difficulties by installing more equipment and rejecting loads of contaminated mixed plastics. Downtime and equipment maintenance and repair costs prohibited Superwood from achieving its first year objectives.

Mississauga had promised to purchase Superwood products. Purchasing orders did not materialize as expected. Superwood Ontario is going to require municipalities supplying plastic for production, as well as other levels of government, to "close the loop" in recycling and promote Superwood products through changes in their procurement policies.

The Superwood products compare favourably to wood in most applications. Environmental sustainability and energy efficiency favours the use of Superwood over wood. Traditional buying habits and the lack of visibility have created the need for a stronger marketing effort to necessitate a change in buying habits and a subsequent improvement in the future potential of Superwood in Canada.

1.0 INTRODUCTION AND BACKGROUND

Perhaps the material that recently has stimulated the most applications activity is plastic. Plastic represents approximately 5 to 8 per cent of the residential solid waste stream, by weight and approximately 10 per cent of the industrial/commercial/institutional waste stream, by weight. Plastics is the fastest growing component, by percentage, of the waste stream.

In the past several years, these materials have become the particular target of public concern. Although plastic is very light, it occupies a disproportionate share of truck space and landfill volume. The resistance of plastic polymers to the effects of biological deterioration and weathering that have made them durable, also make them problematic. As litter, plastic containers and other packaging endure without degrading causing problems for the wildlife that ingest them or get entangled in them. Managing waste plastics by incineration creates another concern in that toxic emissions, according to some critics, are not adequately dealt with through stack cleaning systems.

The amount of plastic in the waste stream has doubled in the past 15 years and is expected to double again by the year 2000. Although some plastics have been recycled in production processes for years, the attempt to recycle mixed waste plastics is relatively new. Currently, about one percent of total plastic waste including plastic soft drink containers is recycled.

Although technology has been developed to sort some plastic resins from a mixed stream of recyclables, most plastic products can be separated, with difficulty, by hand. The Superwood concept was developed to handle the mixed comprehensive stream so that inefficient and costly separations are not required to produce a useful product.

The Superwood technology demonstration project (the project) was initiated to demonstrate its ability to process and manufacture a marketable product made from 100% mixed waste plastics. Hence, Superwood applied through the Demonstration and Development of Resource and Energy Conservation Technology (DRECT) program for

financial support and was awarded a $200,000 grant.

The project funding was for a twelve month project period (June 1990-May 1991). This report covers that timeframe for all aspects of the project with the exception of all production and financial results. These items have been reported to correspond with Superwood's fiscal year (August-July). Undue time and expense would have been spent to assemble and summarize accurate financial information outside of the fiscal period.

1.1 OBJECTIVES OF THE SUPERWOOD PROJECT

The overall objective of this project is to demonstrate, using the machinery built by Superwood International Ltd. (Ireland), that a marketable and saleable product can be processed from mixed post-consumer plastics collected from existing "Blue Box" recycling programs in Ontario.

It is the goal of Superwood Ontario to maintain a consistent price per pound over the timeframe of the project and to produce a consistent number of tonnes per day through the extruder.

The project report goals are to provide information that:

* supports and demonstrates the viability of the product - Superwood.
* supports and demonstrates the technical and financial viability of Superwood.

1.2 HISTORY OF SUPERWOOD

Superwood Ltd. has two co-founders, R.J. Bunyan and F.J. Finnegan in Dublin, Ireland. They acquired the worldwide exclusive rights in 1980 from the inventor of the process. Superwood has developed the process further and created a wide range of products of varying size, colours and shapes, which it markets to municipal, industrial, marine and

agricultural customers.

In 1984, Superwood Ltd. changed its name to Superwood International Ltd., in preparation for international expansion. Superwood International Ltd. soon became known throughout Europe as being the first company able to process a mixed stream of plastic resins into marketable products. The raw material for the Superwood products are mainly thermo plastics, high and low density poly-ethylenes and polypropylenes. The process tolerates small quantities of other plastics such as polyvinyl chloride (PVC), polyethylene terephlatate (PET) etc.

In 1988/89, M.P.I. Limited, a Vancouver based company, acquired the exclusive right to Superwood in most of Canada (excluding Alberta, Saskatchewan and Manitoba) and formed Superwood Ontario Ltd. as a division of M.P.I. Limited.

M.P.I. Limited decided to locate Superwood in Ontario based on two reasons:

1. City of Mississauga was committed to implement a full scale mixed plastic collection through its Blue Box Program.

2. The Ontario Ministry of Environment expressed its willingness to contribute with additional funds in over and above those of the Federal Government.

Superwood Ontario Limited formally began its operation June 1, 1990. The facility was partially funded by Industry, Science and Technology Canada (DRECT program) as a pilot scaled operation with one extruder (Superflow Jumbo Machine) which is rated as being capable of producing 200 kg of Superwood board per hour.

1.2.1 Corporate Structure

Mr. Thane Cochran, president of Superwood Ontario Limited, has over 10 years of management experience in recycling and marketing of recycled materials. The Superwood concept was carefully researched from a strategic and market standpoint

before the company project team was put together. In addition to the employees, several services are acquired from professional consulting companies. Examples of such services are:

* legal service
* accounting and financial service
* laboratory testings and R&D
* documentation and preparation of reports
* storage market development and business development

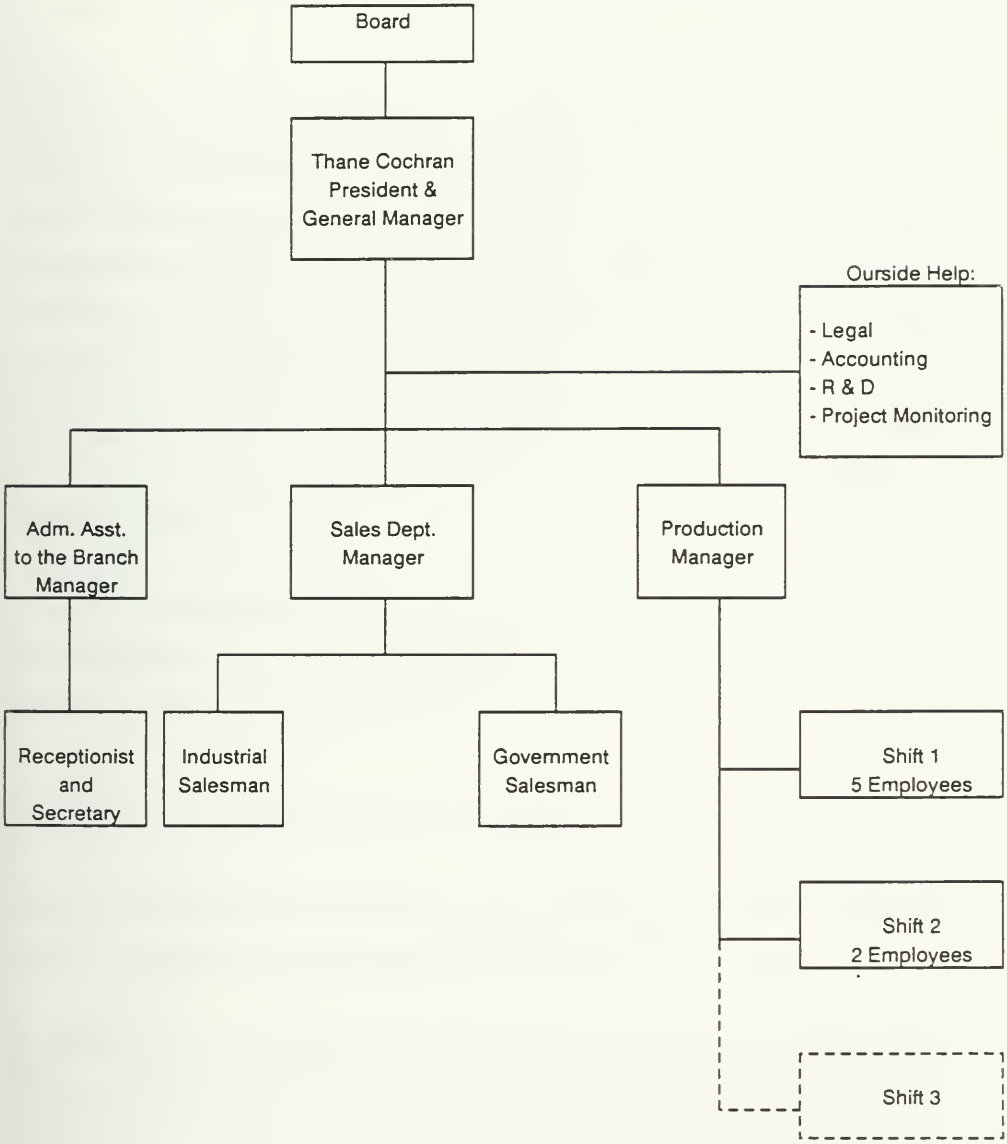
Much effort has been made to train and educate the employees in order to carry each specific work activity towards optimum performance.

Special emphasis was given to the following when key personnel were selected:

* Technical and management ability with respect to multi-disciplinary projects,
* Complete understanding of the requirements to establish a new business including joint ventures, contract negotiations and business development,
* Commitment to improving society's approach to solid waste management through recycling initiatives,
* Experience in relevant recycling, market evaluation and solid waste management feasibility projects, and
* Knowledge of the environmental assessment process and environmental concerns in Ontario.

Mr. Cochran is the former president of M.P.I. Limited. He manages the current operation of Superwood Ontario Ltd. as well as related business development. Mr. Cochran's staff includes one office manager, two outside sales representatives, one production manager and a production workforce of eight. There are 13 employees presently at Superwood Ontario Ltd. (See Figure 1.1). Legal, accounting, R&D and project monitoring (report writing) are carried out to professional and consulting firms.

FIGURE 1.1: Superwood Ontario Limited
Organization Chart



2.0 SUPPLY OF POST-CONSUMER/POST-INDUSTRIAL PLASTICS

2.1 BLUE BOX COLLECTION PROGRAMME

With minor variations between Blue Box collection programmes in each municipality, householders are asked to put clean mixed rigid plastic containers and plastic film in their Blue Boxes. The Blue Boxes are sorted at the curb by the Blue Box collection truck driver. Except for PET (two litre soft drink bottles), all resins are commingled. Further, the recyclables go to an intermediate processing centre (depot) where they are baled and prepared for delivery to Superwood. Unfortunately, some mechanical and hand sorting is required to remove contaminants prior to baling. Within the municipalities involved in the project, a total of approximately 145,400 households could theoretically participate in the Blue Box programme. Studies indicate that 80% of all households with Blue Boxes participate in the programme. No studies have been made in Ontario showing the participation ratio by category or type of item.

Each of the municipalities that supply plastic to Superwood, whether it is done by a private contractor or by a public works department arrange to have the plastic baled and shipped to Superwood's facility in Mississauga.

2.2 THE MUNICIPALITIES SUPPLYING PLASTICS

During the project period, mixed plastics were collected from several municipalities. Table 2.1 indicates the collected quantities of plastics per month for each.

According to a recent Metro Toronto waste composition study, an average household disposes of approximately 23 kilograms of plastic per person per year (Gore and Storrie, 1991, "Residential Waste Composition Study, Volume 1, Ministry of the Environment). Many categories of plastics in that quantity are not a part of the eligible plastics in the Blue Box programme. Examples of such plastics are toys, shoes, kitchen utensils, clothing (synthetic, fibre) and many other durable and semi-durable plastic items. The eligible

plastics for the programme are mixed rigid plastic containers, plastic film and Tetra drinking boxes.

Table 2.1: Raw Materials Receipt by Municipality

MONTH	MISSISSAUGA (tonnes)	MARKHAM (tonnes)	*LINDSAY (tonnes)	*MUSKOKA (tonnes)	
Aug-90	43.36	0.0	0.0	0.0	
Sept-90	43.9	0.0	0.0	0.0	*contain
Oct-90	49.32	0.0	0.0	0.0	tetra-pak
Nov-90	44.12	5.6	0.0	0.0	drinking
Dec-90	39.06	6.6	0.0	0.0	boxes
Jan-91	34.33	5.8	0.0	0.0	
Feb-91	0.0	16.0	24.49	0.0	
Mar-91	49.49	10.9	0.0	0.0	
Apr-91	46.84	6.7	21.77	0.0	
May-91	15.2	6.8	22.68	12.18	
June-91	0.0	35.49	22.73	13.45	
July-91	46.55	0.0	0.0	0.0	
TOTALS	362.85	93.89	91.67	25.63	
Total from Municipal Collection Programme				574.04t	
Tetra Pak School Collection Programme from 160 Schools				20.40t	
GRAND TOTAL OF MATERIALS RECEIVED				**594.44t**	

Based on the sales of food containers and other rigid containers, it is calculated that an average household disposes of 6 kg of mixed rigid plastic containers per year. During the study period, a few bales from each supplier was sorted. The selected bales were collected in November/December of 1990. It was not possible to present a typical breakdown between plastic film, mixed rigid plastic container and other plastics since all bales showed large differences in the composition. For example, the content of mixed

rigid plastic containers varied between 35-70% between the bales.

2.3 INDUSTRIAL/COMMERCIAL/INSTITUTIONAL SUPPLY OF PLASTICS

For the most part, the supply of plastics to the Superwood Facility came from the Blue Box programme. A very small quantity of plastic (5.1 tonnes) was received over the year from local industrial/commercial/institutional (ICI) sources.

2.4 WEIGHTS AND VOLUMES OF WASTE DIVERTED FROM LANDFILLING

In one year, Superwood has received an average of 50 tonnes of mixed plastics per month which is equivalent to a 600 tonnes per year. One tonne of mixed plastics requires approximately 4.5 m^3 of space in a landfill, once compacted. The 600 tonnes of plastic can be said to approximate 2,600m^3 of released landfill space. The value of that space depends on local tipping fees, future value of saved capacity and future cost of new capacity. As an example assuming the Mississauga Britannia Road landfill site total operating cost is $50 per tonne, a savings of $30,000 was realized through diversion of the plastics to the Superwood facility.

3.0 THE SUPERWOOD PLASTICS PROCESSING PROCESS

3.1 INSTALLATION AND START-UP COSTS

The installation of all equipment started in April 1990, and was completed three months later. The production layout and flow of production was based on the same principles as Superwood International Limited (Ireland).

The budgeted cost for equipment was $661,000 plus freight, duty applicable taxes and installation. The budgeted costs were based on 1989 quotes. The final cost for all equipment including installation was $870,000. In addition to the capital start-up costs are the traditional operating costs, (e.g, salaries, rent, utilities, professional services, etc.) from the time of installation to the start of production. Table 3.1 displays the timetable up to the start-up operation of June 1, 1990.

Table 3.1: The Timetable from Initiation to Start-up of the Project

1989	May	Contract signed between Superwood Ontario Limited and the city of Mississauga to receive plastics
1989	June	Submitting Superwood report and application to DRECT
1989	September	Superwood start to accept plastics for their leased building
1989	November	Key personnel notified of employment planned start of operation
1990	January	DRECT approval of grant application
1990	March	Ordering of equipment
1990	April-May	Installation of equipment and hiring of personnel
1990	June	Start of production

3.1.1 List of Equipment used in the Superwood process

Table 3.2 outlines a list of the equipment that was purchased for the production of Superwood.

Table 3.2: Startup costs: Manufacturing and Processing Equipment for Superwood

	Approximate Cost
Fork-Lift (used)	$ 10,000
Bobcat (used)	$ 10,000
Extruder	$ 450,000
Granulator	$ 64,000
Shredder	$ 60,000
Chiller	$ 15,000
Compressor	$ 21,000
Air Conveyors (Granulator)	$ 5,000
Air Conveyors (Mix)	$ 43,000
Baler	$ 10,000
Air Lines	$ 5,000
Electricity	$ 40,000
Silos(3)	$ 15,000
Electrical Spares	$ 5,000
Mechanical Spares	$ 10,000
Moulds(24)	$ 36,000
Cooling Dollies(2)	$ 4,500
Value Added Shop Tools	$ 10,000
Tool Kits	$ 4,500
Controls	$ 24,000
Conveyor and Insp. Table	$ 12,000
Flying Dutchman	$ 8,000
Silo Filling System	$ 8,000
Approximate start up costs	**$ 870,000**

The general floor plan for the Superwood Ontario plant is displayed in Figure 3.1. Figure 3.2 depicts the fate of 100kg of waste plastic entering the feedstock receiving category. During feedstock preparation, 12kg of the incoming feed is removed (e.g., metal, glass, paper, grit, etc.). The remaining 88kg of the feedstock enters the blending/extrusion process and is extruded to Superwood. Plastic trim, off-cuts, shavings

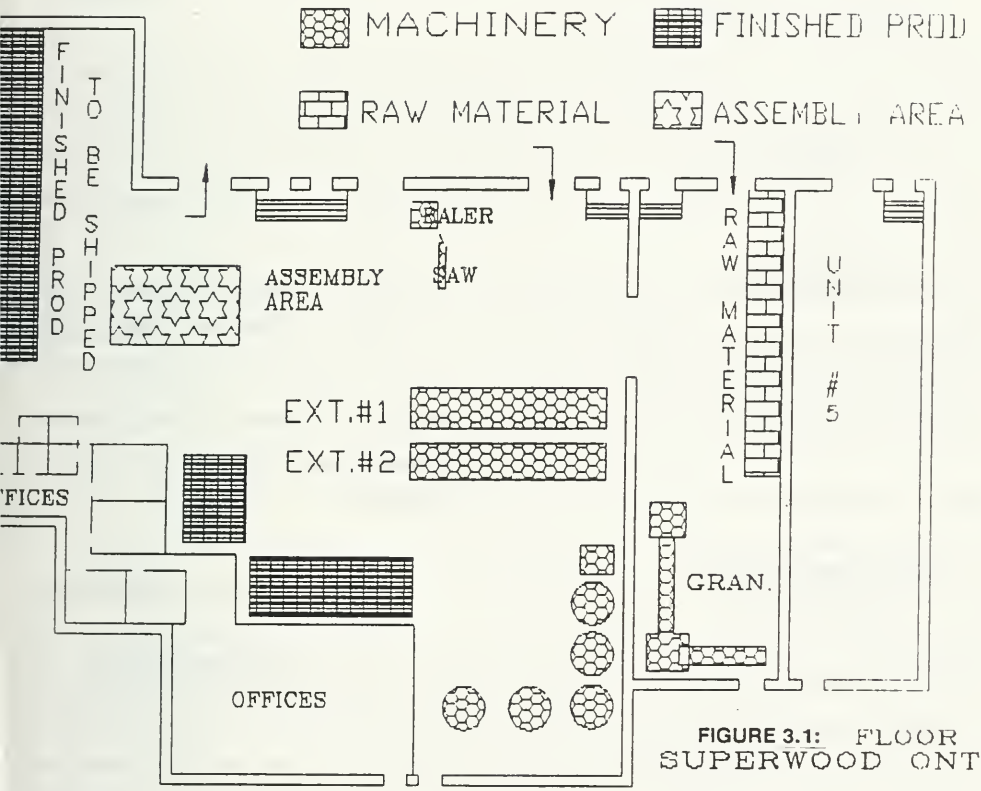
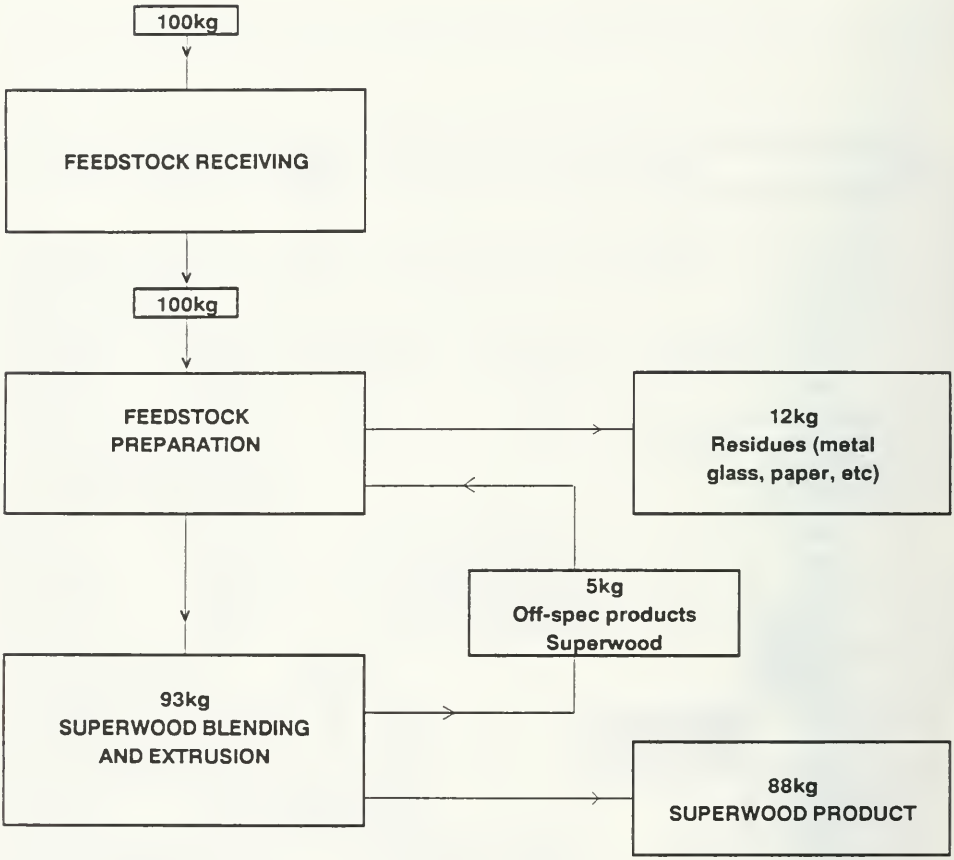


FIGURE 3.1: FLOOR PLAN SUPERWOOD ONTARIO

FIGURE 3.2: Main Processing Categories of the Superwood Process



and products that do not meet specification (5kg) are re-introduced into the continuous process. Each of the six main production elements in the Superwood process is outlined below.

3.2 FEEDSTOCK RECEIVING

All plastics arrive baled. Each 1.3m^3 bale(~1.6m x 1.0m x 0.8m) has a weight between 300 and 500 kg. Each bale is visually inspected, when off-loaded, in order to spot wrong deliveries such as paper bales, etc. Unfortunately, at this inspection it is impossible to identify bales containing excessively high levels of contamination.

Some bales containing only plastic resin, (i.e., film) are stored separately from the mixed plastic bales. Generally, it is difficult to identify the principle resin category, a necessary piece of information to enable control over consistency of plastic feedstock for extrusion. Because of the foregoing, each bale must be broken and the contents manually inspected and judgements made on the basis of the visual inspection.

3.3 SORTING

The sorting discussed above was originally not expected to be the major work activity as it is now. The raw material derived from houshold and truck driver source separation was expected to be free from excessive amounts of glass, stones, metals and other contaminants. The Superwood production system was designed to tolerate a small contamination content (of up to 3% by weight). The contamination content was determined to be 8 -12% by weight after completing a special sorting study in January 1991. Because of this, each processed bale has to be manually sorted before entering the conveyor belt for shredding. This turned out to be a labour-intensive, time-consuming process resulting in high costs and reduced product throughput. Not to sort out the contaminants would result in excessive maintenance and early replacement of parts (due to the abrasive nature of glass, metals, etc.) and poor quality of the final product (due

to excessive amounts of paper), The major reason for this supply quality problem was identified to be a combination of the following:

1. Some householders put the contaminants (glass, newspaper, fabrics etc.) inside plastic bags and these plastic bags are not opened prior to baling.

2. Cross-contamination in the collection vehicle at the Blue Box Depot.

3. The baling process crushes and breaks the brittle contaminants (glass, ceramics, etc.) and, at the same time, presses them into the plastic feedstock.

Currently, the contaminants that are pulled out (glass, stones, fabric, etc.) are being shipped to Peel Region's landfill for landfilling at a zero tipping fee charge.

3.4 SHREDDING AND MIXING

This work activity is essentially feedstock preparation. After the bale has been broken and easily removed contaminants pulled out, by hand, material is cut and shredded. The shredded rigid plastics and flexible plastic film are mixed in a blender. Samples for the blend determine if the mix is rich in high density plastics. If the high density plastic content is too low (less than 30%), additional high density plastic is added.

There are three different methods available for a feedstock preparation:

Fluffing: Fluffing producing a mixed loose fine shredded plastic is the least expensive feedstock preparation. However, plank extrusion times are longer.

Granulating: Granulation produces a more dense feedstock. The equipment required to granulate the material is expensive and the extrusion time saving does normally not justify the investment.

Densifying: Densifying falls between the fluffing and the granulation as related to the density of the plastic feedstock. Superwood uses this method.

3.5 BLENDING

After preparation, the mixed plastics are blended and stabilizers (1% by weight) and pigments (2% by weight) are added. The result is a feed or 'recipe' that is screw fed into the extrusion machine. Different 'recipes' are based on the intended use of the product. For example, a 'recipe' containing a high percentage of high density polyethylene is suitable for extruding fence posts. By using different quantities of stabilizers and pigments, different physical properties are achieved. Another 'recipe' based on the addition of two per cent (2%) carbon black pigment results in a product with UV-resistance in excess of 250 years.

3.6 EXTRUSION

The extrusion process includes the following:

* extrusion
* cooling

The Superflow extrusion process requires one full time operator. Since the extruder is largely automatic, the operator has sufficient time to move and rack the extruded products. A variety of moulds are used to extrude different cross-section profiles, always of the same length because of the configuration of the extruding machine.

The extruded planks or other cross-sections are cooled in water for between 10 and 30 minutes, depending on the thickness of the extruded product which governs the amount of heat to be dispersed. The cooled product is then ejected from its mould using compressed air. Some trimming on the two ends if often necessary to permit ejection.

The finished Superwood 'lumber-like' product can be further processed for the end user. The development of value added products from basic Superwood extruded planks increases Superwood applications. Types of processes that have been used in pilot scale are:

* special colour finish
* shaping by sawing and routing
* preparation of kits for assembling into products

3.7 STORAGE AND SHIPPING

After the extruded product has cooled, the product is stock piled and set out for shipping. As with product handling, the planks and profiles are appropriately stored ensuring that shipping procedures do not damage the product.

3.8 STAFF AND MANAGEMENT REQUIREMENTS

Superwood Ontario began shift operations a few months after the official opening. Originally only one shift was employed, however, because the feedstock was so heavily contaminated, a second shift was added to meet objective throughput rates. Contamination levels caused the sorting and shredding operations to be the limiting factor in the Superwood operation. The present work schedule and required staff and management requirements are outlined in Tables 3.3 and 3.4.

Table 3.3: Shift Work Schedule for Superwood Ontario

	Shift 1	Shift 2
Monday	8:00 am - 8:00 pm	8:00 pm - 8:00 am
Tuesday	8:00 am - 8:00 pm	8:00 pm - 8:00 am
Wednesday	8:00 am - 8:00 pm	8:00 pm - 8:00 am
Thursday	8:00 am - 8:00 pm	8:00 pm - 8:00 am
Friday	8:00 am - 8:00 pm	8:00 pm - 8:00 am
Totals	48 hours/week	48 hours/week
Management and Administration	8:00 am - 5:00 pm 45 hours/week	

Some sorting and grinding is sometimes done on Fridays by non-regular staff.

Table 3.4: Shift and Management Requirements for Superwood Ontario

	Assignment	Number of Employees
Day Shift	President	1
	Office Manager	1
	Secretary/Receptionist	1
	Salesman	2
	Production Manager	1
	Sorting Table	1
	Shredder/Blender	1
	Extruder	2
Total (day shift)		10
Night Shift*	Extruder	2
	Sorting Table	1
Total (night shift)		3
TOTAL NUMBER OF EMPLOYEES		13

*The night shift staff is also assigned some shredding as well as some cleanup of the floor, conveyor belt and sorting table. During a few short periods of stalled production, the two production shift staff are assigned to do baled feedstock sorting.

4.0 PRODUCT EVALUATION PROGRAMME

4.1 DESCRIPTION OF THE EVALUATION PROGRAMME

Part of the project was to test the product Superwood in order to determine its physical properties and performance.

All tests in this report were conducted by Ortech International in 1990. All tests have been analyzed and controlled by an authorized controller. A total of 20 samples of Superwood from three different batches were collected and sent to Ortech for testing. All data provided in this report for comparing wood, concrete and steel to Superwood comes from the Standard Handbook for Civil Engineers, McGraw, Hill. The information about UV-light comes from the National Research Council of Canada (Report Paper No. 940, Ottawa 1988); and the research information about the research information about the nailholding test from "Engineering Design in Wood (Canadian Standard Association (CSA), handbook Can 3-U86.1-M84".

4.2 PRODUCT TEST RESULTS

This section describes the technology demonstration in brief and includes test results performed by an independent testing laboratory.

All material test results presented in this report were conducted by Ortech in accordance with American Standard Test Methods.

The 20 samples were forwarded for tests under the following headings:

* Density
* Water absorption
* Flexural strength
* Tensile strength
* Flexural modulus of elasticity

* Fungal resistance
* Bacterial resistance

4.3 PROPERTIES OF SUPERWOOD

Superwood has properties similar to dense hardwood. It is able to be worked with conventional wood working tools, and can be joined with nails and screws. While it cannot be glued, it can be heat welded.

Major advantages of Superwood:

* It does not rot, absorb moisture, harbour or support mould or fungi
* It requires no painting or other surface finishing
* the surface is readily cleaned
* It has an almost indefinite lifetime, estimated to be in excess of 100 years
* It does not break or splinter under stress but bends and stretches
* It is resistant to the chewing of animals
* It does not shrink or swell with changes in atmospheric moisture or exposure to wet environments
* Superwood can be extruded to finished dimensions (rather than having to plane or rip wood to the size required) and a variety of shapes adapted to particular uses
* It can be supplied in a range of colours and surface finishes (e.g., smooth, textured, raised woodgrain)
* Superwood can be totally 're-recycled' an unlimited number of times

Disadvantages of Superwood:

* It has a relatively high coefficient of thermal expansion (i.e., the product elongates when heated)
* A special application technique is required to produce colour finishes for aesthetic purposes

* Superwood is 20-50% more expensive than competing products such as medium grade western white pine.

A survey of possible uses has been made to enable an estimate of their market potential. Estimates of the price differential which could be obtained for the product have been made. A price comparison between Superwood and Pressure Treated Lumber is made in Chapter 6.

4.4 TEST RESULT VARIATIONS

The material test results in this report are compared with the following construction materials:

* Sitka Spruce
* Western White Pine
* Concrete (Portland)
* Structural Steel

Comparisons between the above materials and Superwood should be read with caution because of property variations. The two types of wood used in the comparison (Sitka Spruce and Western White Pine) show wide variations in tensile and flexural strength, depending on location of growth, quality of the tree, time for harvest and orientation of the test (i.e., parallel or perpendicular to the grain), etc. Structural steel has other variations such as micro-cracks and carbon-content, etc. Concrete has a completely different set of physical properties than the other materials shown in the comparison. Concrete performs well only in compression. The results of the tests have been summarized in Table 4.1.

Table 4.1

Summary of Test Results

CATEGORY	Superwood	Steel	Concrete	Sitka Spruce	Western White Pine
Water absorption(%)	1.5	N/A	N/A	+28	+30
Density (g/cm^3)	0.80	7.50	2.40	0.40	0.38
Flexural Strength(psi)	2,800	36000	3,800	1600-4500	1400-4200
Tensile Strength (psi)	1,433	58000-80000	N/A	900-1150	700-850
Flexural Modulus of Elasticity(psi)	128000	29000000	4500000	1570000	1500000
Bacterial Resistance	Yes	No	Yes	No	No
Fungal Resistance	Yes	No	Yes	No	No
Nailholding	Yes	No	No	Yes	Yes

4.5 WATER ABSORPTION

The water absorption ratio for Superwood is 1.5% (ASTM D 570 test method). During the moulding process, almost all moisture is evaporated. The finished product contains less than 0.1% water content.

Water Absorption

Superwood (ASTM D 570) less than	0.1%	1.5%
Sitka Spruce (kiln dry)	12 - 14%	>28.0%
Western White Pine (air dry)	15 - 17%	>30.0%

4.6 FUNGAL RESISTANCE

The fungal resistance was tested in accordance with U.S. Military Standard 810 D method 508.3.

The results on Superwood showed no signs of visible fungal growth because the surfaces on plastics do not hold "nutrients"to support fungal growth. The fungal resistance test was performed on Superwood made of 100% plastics. Wood treated with creosote, PCP or other fungal treatment chemicals, supports a fungal growth.

4.7 BACTERIAL RESISTANCE

The bacterial resistance was tested in accordance with ASTM G-22. Results showed that none of the samples supported bacterial growth. Wood treated with creosote, copper sulphate, PCP and other treatment chemicals support fungal growth.

4.8 DENSITY

The density test was determined in accordance to ASTM D 1895 (gram/cm^3).

Materials Tested	(g/cm^3)	(lb/cb.ft)
Superwood (ASTM D 1895)	0.70	44
Water	1.00	62.4
Sitka Spruce (12% moisture)	0.40	25
Western White Pine (12% moisture)	0.38	24
Concrete	2.40	150
Structural Steel	7.50	468

Since Superwood has a specific gravity of less than 1.0, it floats even allowing for a water absorbtion ratio 1.5%. Superwood will continue to float even after an unlimited time in

water, while wood will sink once it becomes saturated with water.

4.9 ULTRAVIOLET TEST

Ultraviolet (UV) light may cause a deterioration of plastic materials. Deterioration starts at the outer surface and may take the form of discolouration, pitting fibre prominence and micro cracking. Rates of absorption of ultraviolet radiation wave-lengths in a plastic object is called "ultraviolet absorption spectrophotometry" (SPECT). SPECT studies the spectrum produced by the absorption of ultraviolet energy during the transformation of an electron and is measured in nanometre/seconds.

The most commonly used UV stabilizer are hydrocarbon polymers and carbon black pigment. The pigment accounts for the photo-initiated degradation and prevents the light (energy) from penetrating deeply into the material. A black body, therefore, absorbs practically no UV light. Other absorbing groups are carbonyls, carboxyls, peroxides and carbon-carbon double bonds. Thermal effects during weathering are determined by the actual temperature of the material, especially at the surface where the deterioration occurs. The UV deterioration rate for plastics is between 2-5 mil per year (2-5 thousands of one inch per year). The deterioration tests are done on a white pigmented body. Any pigment darker than white reduces the deterioration. An absolute black body has almost no UV deterioration.

The plastic lumber-like product produced by Superwood Ontario contains a mix of plastic resins. All products are pigmented with standard carbon black in order to produce a black product. The thinnest product currently manufactured (Superboard) has a dimension of 1/2 inch.

Thickness	1/2 inch
Unit	1/2 inch = 1.27mm
Colour	black
Deterioration per year	2-5 mill (one-thousandth of one inch = 1 mill)
in a white object	= 0.00508 mm - 0.0127 mm

Assuming that the deterioration occurs evenly around the product, a complete deterioration would take 50 to 125 years for a white product. When black pigment is added to act as a UV stabilizer, the deterioration of Superwood's black pigmented plastic lumber has an even longer lifetime than 50 - 125 years.

Superwood Ontario, therefore, can sell its product claiming it has excellent UV resistance.

The information for this aspect of the test was received from the National Research Council of Canada and its Report Paper No. 940 (Division of Building Research) Ottawa, 1988.

4.10 MECHANICAL TESTS

Three different mechanical tests were made in accordance to ASTM D 790 (Flexural Strength), ASTM D 638 (Tensile Strength) and Flexural Modulus of Elasticity relation between ASTM D 790 and ASTM D 638.

ASTM D 790	Flexural Strength (psi)
Superwood	2,800
Sitka Spruce *	1,600 - 4,500
Western White Pine *	1,400 - 4,200
Concrete (Portland)**	3,800
Structural Steel ***	36,000

*Proportional limit **Compression test result ***Yield strength

A valid conclusion between the compared materials relative to flexural strength is difficult to make because they are tested differently. Wood shows different flexural strength results depending on the quality of the tested material, place of growth and time of harvest and orientation of the grain. Concrete is generally tested for compression and structural steel is reported by tensile strength.

4.11 TENSILE STRENGTH

The tensile strength was conducted according to ASTM D 638.

MATERIAL	
ASTM D 638	(psi)
Superwood	1,433
Sitka Spruce *	900-1,150
Western White Pine *	700-850
Concrete (Portland) **	N/A
Structural Steel ***	58-80,000

*Shearing strength parallel to grain

**Generally not reported

***Varies depending on the carbon content

Superwood has a better tensile strength than wood. The conclusion is that Superwood is less brittle than the two wood types compared.

4.12 FLEXURAL MODULUS OF ELASTICITY

The inter-correlation between tensile strength and flexural strength is measured in flexural modulus of elasticity. The results of the flexural modulus of elasticity test are outlined below.

MATERIAL	**Flexural Modulus of Elasticity** (pounds per square inch)
Superwood	128,000
Sitka Spruce	1,570,000
Western White Pine	1,500,000
Concrete	4,500,000
Structural Steel	29,000,000

The flexural modulus of elasticity indicates how much an object can elongate before failure. Superwood, at 128,000 versus wood at 1,500,000, gives Superwood an almost 12 times higher rating relative to elasticity of wood at the same stress. Plastics have the ability to retain an original shape after having been bent. In many applications, it is of benefit to use a material with a low value of flexural modulus of elasticity that can cope with stresses from ice, snow and other natural causes of impact.

4.13 NAILHOLDING TEST

In addition to the above tests, nail pull-out tests were conducted. A specific ASTM standard for testing for nailholding of plastic has not been established.

The nailholding test most suitable for plastic is ASTM F 680 (guidelines for nail-holding). The following values were obtained:

Pull-Out Test (ASTM F 680)

Bolts	
4-inch bolt	545 kg. (1200 lb)
6-inch bolt	908 kg. (2000 lb)
Ring Shank Nails	
24 rings embedded	272 kg (600 lb)
20 rings embedded	222 kg (490 lb)
16 rings embedded	163 kg (360 lb)

(**Note:** Bolt specimens were prepared by drilling a 1/8 inch pilot hole before driving the bolt.)

It is not possible to come to any comparison conclusions on this test since the test on wood and plastics are made differently, and there are no specific ASTM codes for testing nailholding in plastics. However, the values above support conclusion that the

nailholding capacity in Superwood is good.

4.14 PRODUCT PERFORMANCE CONCLUSIONS

Superwood is a product containing a mix of different plastic resins, dominated by HDPE, and LDPE which represents approximately 75% by weight. Superwood, in comparison to regular untreated construction wood (spruce/pine/fur) has features, based on the test results, that can be categorized in 3 groups.

1. Superwood features, which are better than wood, include:
   * Superwood is unaffected by rot, insets and fungus
   * Superwood does not splinter like wood or absorb water
   * Superwood does not absorb water

2. Superwood features, which are comparable to wood, include:
   * Superwood has a very good nailholding capacity
   * Superwood acts as an electric insulator
   * Superwood floats in water
   * Superwood has a tensile strength and flexural strength similar to wood

3. Other Superwood features include:
   * Superwood has approximately 12 times higher elasticity factor than wood
   * Superwood can be recycled an unlimited number of times - wood cannot

The other materials listed for test category (concrete and steel) are included in order to provide a context for comparing Superwood to other building materials.

5.0 ENVIRONMENTAL AND ENERGY ANALYSIS

This analysis is presented in a qualitative overview only. It is well beyond the scope of this report to undertake a quantitative overview of the environmental and energy savings realization through the use of Superwood compared to its "competition"(i.e. wood, steel, concrete). The level of effort required to undertake such an endeavour is not included within the original framework of this project.

5.1 ENVIRONMENTAL SUSTAINABILITY THROUGH SUPERWOOD

Canadian waste composition studies indicate that plastics in the residential solid waste comprise approximately six per cent by weight and in the ICI waste stream approximately eight per cent by weight. This means the theoretical weight of plastics available for recycling totals approximately 1.5 million tonnes per year in Canada. However, generally less than 5,000 tonnes were recycled in Canada in 1990 (See Figures 5.1 and 5.2). This represents 0.3% of the potentially recyclable plastics waste stream.

Using the Superwood process, 1.5 million tonnes of plastic could be made into 1.5 million tonnes of Superwood "lumber". If all of the plastic was recycled and manufactured into 2" x 4"'s, and assuming a mass of 3.93kg/linear metre, approximately 382,000 metres (630,000 board feet) of 2" x 4" "lumber"could be produced. Represented another way, and assuming the densities outlined in Chapter 4, 857,000 tonnes of finished wood lumber would have to be cut to produce the same number of metres of 2" x 4" boards.

In addition to the potential resource savings of recycling plastic into "lumber"instead of using real wood, another resource saving is in the diversion of plastics from landfilling. Diverting plastic to recycling through the Superwood process, assuming one tonne of plastic requires approximately 4.5m^3 of volume in a landfill, more than 6.7 million cubic metres of landfill space could be released. Represented in monetary terms, assuming a landfill tipping cost of $50 per tonne, $75,000,000 could be saved from the cost of landfilling.

FIGURE 5.1:

Estimated Canadian Residential Plastic Waste Generation and Diversion Data (1990)

Waste Categories	Percent Comp.	Total Baseline (tonnes)	Per Cap Gener. (kg/year)	Per Cap Gener. (kg/day)	% Com	Reduction (tonnes)	% Com	Reuse (tonnes)	Total Generated (tonnes)	% Com	Recycled (tonnes)	Disposal (tonnes)
PLASTIC PACKAGING												
Rigid Plastic Containers												
HDPE	0.700%	70,000	2.800	0.008					70,000	5%	3,500	66,500
PET	0.090%	9,000	0.360	0.001					9,000	15%	1,350	7,650
Polystyrene	0.020%	2,000	0.080	0.000					2,000		0	2,000
PVC	0.050%	5,000	0.200	0.001					5,000		0	5,000
Polypropylene	0.010%	1,000	0.040	0.000					1,000		0	1,000
LDPE	0.001%	100	0.004	0.000					100		0	100
Other	0.006%	600	0.024	0.000					600		0	600
Sub-Total	0.877%	87,700	3.508	0.010					87,700		4,850	82,850
Plastic Film												
LDPE	0.900%	90,000	3.600	0.010					90,000	0.1%	90	89,910
HDPE	0.050%	5,000	0.200	0.001					5,000		0	5,000
Other	0.050%	5,000	0.200	0.001					5,000		0	5,000
Sub-Total	1.000%	100,000	4.000	0.011					100,000		90	99,910
Other Plastic Packaging	1.370%	137,000	5.480	0.015					137,000		0	137,000
TOTAL PLASTIC PACKAGING	3.247%	324,700	12.988	0.036					324,700		4,940	319,760
PLASTIC PRODUCTS												
Miscellaneous products	3.250%	325,000	13.000	0.036							0	325,000
TOTAL RESIDENTIAL PLASTICS	6.497%	649,700	25.988	0.071							4,940	644,760

Total Population	25,000,000
Generation Rate/kg/capita	400
Diversion Rate	0.8%

Sources:
- Canadian Plastics End-Use Markets analysis, 1986-1996, S.P.I.
- Adapted from Proctor & Redfern file data
- Adapted from "Ontario Waste Composition Study" Volume 1, MOE, January, 1991

Proctor & Redfern Limited

FIGURE 5.2:

Estimated Canadian Institutional/Commercial/Industrial (ICI) Plastic Waste Generation and Diversion Data (1990)

Waste Categories	Percent Comp.	Total Baseline (tonnes)	Per Emp Gener. (kg/year)	Per Emp Gener. (kg/day)	% Com	Reduction (tonnes)	% Com	Reuse (tonnes)	Total Generated (tonnes)	% Com	Recycled (tonnes)	Landfill (tonnes)
PLASTIC												
Bottles, Jugs, Tubs, Pails	1.50%	112,500	15.0	0.041					112,500		0	112,500
Piping	0.01%	750	0.1	0.000					750		0	750
Film	4.50%	337,500	45.0	0.123					337,500		0	337,500
Semi-Rigid	0.50%	37,500	5.0	0.014					37,500		0	37,500
Foam	0.90%	67,500	9.0	0.025					67,500		0	67,500
Small Post Consumer Goods	1.30%	97,500	13.0	0.036					97,500		0	97,500
Large Post Consumer Goods	0.40%	30,000	4.0	0.011					30,000		0	30,000
Manufacturing & Inventory Scrap	0.70%	52,500	7.0	0.019					52,500		0	52,500
Other	1.50%	112,500	15.0	0.041					112,500		0	112,500
TOTAL ICI PLASTIC	11.31%	848,250	113.1	0.310					848,250		0	848,250

Total Employees	7,500,000
Generation Rate/kg/employee	1,000
Diversion Rate	0.0%

Sources:

- Adapted from Proctor & Redfern file data

The resource savings utilizing Superwood also has a built in multiplier effect. Superwood products generally have a better life expectancy than competitive wood products. Whereas when a wood product is no longer of use or is destroyed, it must be replaced often with more virgin wood. Superwood products which are destroyed can be easily re-ground and made into new Superwood planks with an efficiency of recycling to end product production of 100%.

5.2 ENERGY SAVINGS REALIZATION THROUGH SUPERWOOD

For the purposes of this report, a qualitative examination of the relative paths in the production of Superwood "lumber"and wood lumber will be followed in a path analysis.

The plastic required for the production of Superwood originates in the Blue Box. Ninety per cent of the Superwood end product originates as post-consumer mixed plastics. Five per cent is regrinds of off-specification Superwood production and five per cent is comprised of Tetra Pak containers. The path of energy consumption is as follows:

SUPERWOOD

0. The Mississauga, Markham, Lindsay or Muskoka householder chooses between discarding the plastics in the waste stream and the recycling stream.
1. The plastics and Tetra Pak are collected in the Blue Box by the Blue Box collection truck.
2. The collected plastic is transported to a transfer station where the plastic is baled into 1.3m^3 bales.
3. The bales are transported to the

WOOD

0. The mature tree is growing in a remote location.
1. The tree is stripped of all of its branches and leaves and is cutdown. Minor slash is left on the ground.
2. The coarse slash is collected and transported for production into lumber products (eg. aspenite, masonite, etc).

2a. This slash is chipped and sent for processing into alternative lumber

Superwood Ontario facility in Mississauga.

The bales are broken open.

The contaminants (~12%) are removed.

The plastics are shredded and conveyed to one of five silos, ready for mixing.

The extruder processes finished surface Superwood on a "tonnage in" equals "tonnage out" ratio (minus approximately five per cent off-specification material which is recycled into the shredder line).

The final product is available to the consumer for purchase.

products. The process requires the addition of resins or glues and pressure to produce other lumber products (eg. aspenite).

3. The log is collected and transported to the lumber mill.
4. The log is barked, squared and rough cut to its required dimensions.

4a. The rough cut slabs are transported to another area for milling into smaller lumber sizes or are sent for chipping and processing into another product (eg. aspenite) or are burned as hog fuel.

4b. The process of aspenite production requires the input of resins and pressure.

5. The lumber is moved to another area for planing into its nominal size.

5a. The shavings and sawdust are collected and transported to another area for manufacture of other lumber products, requiring resins and pressure (energy) and/or is transported for disposal.

6. The lumber products are set kiln dried.
7. The final product is available to the consumer for purchase.

Primarily, the energy costs fall into two categories in the production of Superwood: 1. transportation (fuel costs) and 2. production (electricity costs). In the production of Superwood in Ontario through this pilot project, the majority of the materials originated and were transported in the same municipality - The City of Mississauga. This translates to low transportation costs.

In the production of an equivalent amount of wood lumber the path has many places where waste material or material needs to be diverted into another area for production. Generally speaking the efficiency of the lumber manufacturing process is much lower than that for Superwood. Although in the process of milling there is the "benefit"of the production of a number of by-products, the efficiency of the lumber processing aspects of the process are quite low. This is based on having to handle a number of "waste materials", constant movement of the materials for reprocessing, and the amount of materials in any given tree that is not available for production into lumber and lumber byproducts. This leads to the conclusion that the amount of energy that is required for the production of any given quantity of board feet of lumber requires a great deal more energy than an equivalent amount of Superwood.

The Superwood process is very efficient in its use of materials in that for every 100 tonnes of useable plastic that goes into the mixing and extrusion process, 100 tonnes of finished "lumber"products is produced. The five per cent of production which is off specification is recycled in the plant by regrinding and reprocessing.

Due to its long life, Superwood also shows energy efficiencies over lumber. If a piece of lumber is damaged and needs replacement, the entire process once again has to be undertaken to replace that piece of wood. If a piece of Superwood lumber is damaged and needs replacement, the original piece is sent to the plant for "re-recycling"into a new piece of Superwood "lumber".

6.0 PRODUCTION RESULTS

6.1 QUANTITIES OF MATERIALS PRODUCED

The tonnes of Superwood products produced are outlined by month in Table 6.1.

Table 6.1: A monthly summary of quantities of Superwood produced.

MONTH	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
QUANTITY (000kg)	18.6	14.1	27.8	19.7	9.5	10.3	25.2	11.5	47.3	28.1	34.8	6.3

In the one year from August 1990 to July 1991 the Superwood Ontario facility produced 253.2 tonnes of Superwood lumber.

6.2 SUPERWOOD PRODUCTS PRODUCED

Table 6.2 outlines a list of all the products the Superwood Ontario facility produces. Table 6.3 provides a product price comparison between Superwood products, spruce, cedar and pressure treated lumber products.

Figure 6.1 summarizes Superwood Ontario's sales and production for the fiscal year 01 August 1990 to 31 July 1991. Figure 6.2 summarizes the Superwood products sold over the fiscal year by product and quantity sold.

Table 6.2: A Summary List of Presently Available Superwood Products

SIZE	6'(length)	8'(length)	10'(length)	lbs/lin. ft.
1" x 4"	X	X		1.32
1" x 6"	X	X		1.98
1.5" x 4"	X		X	1.98
1.5" x 6"	X		X	2.98
2" x 3"	X			1.98
3" x 3"	X		X	2.98
4" x 4"	X		X	5.29
2" ROUND	X			1.26
SUPERBOARD		X		2.41 (sq.ft.)
CURB STOP	X			9.17
PIG SLATS (4')				1.22

VALUE ADDED PRODUCTS INCLUDE: PALLETS, PICNIC TABLES AND BENCHES

Table 6.3: A Product Price Comparison for Superwood and Wood Products

DIMENSION	SPRUCE	CEDAR	PRESSURE TREATED WOOD	SUPERWOOD
1" X 4" X 8'	$1.12	$2.00		$4.23
1" X 6" X 8'	$1.68	$3.68	$2.64	$6.35
2" X 4" X 8'	$2.19	$3.76	$2.96	$8.47
3" X 3" X 8'	$2.80			$9.52
4" X 4" X 8'	$5.20	$9.20	$6.48	$16.92
1/2" PLYWOOD				
G1S FIR	$21.98			$60.00
G2S FIR	$39.98			$60.00

Prices are correct as at 16 September 1991. Wood prices provided by Lansing Buildall, Mississauga.

MONTH	QUANTITY PRODUCED	QUANTITY SOLD/SHIPPED	PRICE/kg ($/kg)	VALUE ADDED	SALES	SALES BY QUARTER	INVENTORY BALANCE (kg)*
AUGUST '90	18,600	5,200	$1.50	$3,600.00	$8,798.82		4,900
SEPTEMBER '90	14,100	6,660	$1.50	$16,600.00	$14,468.18		8,500
OCTOBER '90	27,800	11,900	$1.43	$0.00	$1,461.60	$24,728.60	24,400
NOVEMBER '90	19,700	5,390	$1.50	$9,600.00	$16,412.65		38,710
DECEMBER '90	9,500	2,001	$1.43	$0.00	$7,116.70		46,209
JANUARY '91	10,300	4,790	$1.46	$0.00	$12,210.86	$35,740.21	51,719
FEBRUARY '91	25,200	5,760	$1.40	$0.00	$24,282.12		71,159
MARCH '91	11,475	14,129	$1.38	$0.00	$20,308.53		68,505
APRIL '91	47,270	31,100	$1.39	$0.00	$28,324.47	$72,915.12	84,675
MAY '91	28,100	17,100	$1.32	$0.00	$29,961.19		95,675
JUNE '91	34,800	15,821	$1.32	$0.00	$15,111.69		114,654
JULY '91	6,345	2,542	$1.32	$0.00	$9,154.37	$54,227.25	118,457
TOTALS	253,190 kg	122,393 kg	$1.41 (avg)	$29,800.00	$187,611.18	$187,611.18	60,630 (avg)

*An estimate only. Samples offers were not directly recorded and taken off of inventory listings.

FIGURE 6.2: A SUMMARY OF PRODUCTS SOLD BY SUPERWOOD FOR THE PERIOD 01 AUGUST 1990 TO 31 JULY 1991

PRODUCT	QUANTITY SOLD (units)	PRODUCT	QUANTITY SOLD	PRODUCT	QUANTITY SOLD	PRODUCT	QUANTITY SOLD
4"x4"x10'	156	3"x2"x30"	40	1"x6"x45"	50	PALLETS	
4"x4"x8'	10	2"x4"x8'	102	1"x4"x8'	10	54"X54"-4 way	65
4"x4"x6'	99	2"x2"x4'	2708	1"x4"x6'(grey)	8	48"X48"-4 way	13
4"x4"x54"	36	2"x2"x6'(round)	77	1"x4"x6'(black)	1615	48"X40"-4 way	61
4"x4"x5'	2	2"x2"x3'(round)	80	1"x4"x50"	120	42"X42"-4 way	3
4"x4"x4'	8	1.5"x6"x10'	40	1"x4"x4'	240	40"X40"-4 way	5
4"x4"x2'	2	1.5"x6"x6'	1421	1"x4"x45"	428	56"X44"-2 way	6
3"x3"x10'	10	1.5"x6"x4'	85	1"x4"x40"	2	48"X48"-2 way	22
3"x3"x6'	1883	1.5"x6"x3'	11	1"x4"x3'	40	48"X40"-2 way	37
3"x3"x45.25"	360	1.5"x4"x10'	40	1"x4"x30"	40	44"X44"-2 way	6
3"x3"x45"	30	1.5"x4"x6'(grey)	4	SEATS/BENCHES		42"X48"-2 way	3
3"x2"x6'	2931	1.5"x4"x6'(black)	3673	SEAT/NO BACK	10	40"X40"-2 way	54
3"x2"x66"	50	1.5"x4"x54"	96	SEAT/W. BACK	74	PICNIC TABLES	
3"x2"x44"	300	1"x6"x8'	2	PICNIC BENCH	2	RECTANGULAR	63
SUPERBOARD	43	1"x6"x6'	122	KERB STOPS	41	HEXAGONAL	8

6.3 PRODUCTION PROBLEMS

Three principal problems have been identified in the production of Superwood. These are:

1. Raw material quality

There have been a number of problems with the raw material quality. Contamination of the incoming plastics by glass, metal, paper, moisture, food waste and residue left in the containers slow down production because of an increased sorting time and wear on the equipment. Glass and metal are abrasive and this causes wear on machinery such as extruder screws and augers, granulator blades, etc.

Moisture, food wastes and residues cause reactions in the melting process which not only affects product quality but also throughput of the machinery. The raw materials are processed at temperatures between 180 and 220 degrees Celsius. At this temperature which is much higher than the boiling point of water, steam is a by-product of production. This steam can create huge pressures which may damage moulds or create excessive flashing which must be removed with a hammer and chisel. Porosity in the product is also a result of moisture, contaminants and residues in the raw materials.

There are two short term solutions to the contamination and moisture problems. The first is reducing the amount of post-consumer plastics in the process. The second is washing, drying and separating all of the raw material. The long term solution, and the best one, is to increase public education to produce better source separated materials at the Blue Box.

2. Grinding Capacity

Another problem is the bottle neck in the system at the granulator. The granulator presently used has a 25hp motor and with it, two 75hp molding machines are fed. The granulator has a throughput of 250 lbs (114kg) per hour while the goal for the molding

7.0 FINANCIAL ANALYSIS

This chapter outlines the financial analysis for Superwood Ontario for their fiscal year 01 August 1990 to 31 July 1991. The figures reported herein have not been audited. The auditors were preparing the audited statement during the week of 23 September 1991 and will have it completed for review some time in October 1991. A financial Income Statement and Balance Sheet can be found in Tables 7.1 and 7.2 respectively.

7.1 SALES AND REVENUES

Superwood Ontario reported a total net sales of $187,611.18 for the fiscal year ending 31 July 1991. Products were marketed at an average cost of $1.41 per kilogram.

Other revenues totalled $40,351.68 for the fiscal year. The bonus income reported represents a fee for service for handling the Tetra Pak drinking boxes in the recycling programme.

7.2 COST OF PRODUCTION

7.2.1 Manufacturing costs

The manufacturing costs for the materials produced totalled $252,687.37. Referring to Table 7.1, it can be seen that equipment maintenance and repair accounted for more than 25 per cent of the manufacturing costs. Better quality control on the materials shipped by the municipalities for processing will decrease the problems associated with contaminants and therefore will reduce downtime and maintenance costs.

7.2.2 Cost of goods available for sale

The total cost of goods available for sale was $632,380.42. This figure reflects all labour costs, materials purchasing, freight, fabrication, research and development and remanufacturing costs. This figure also includes a cost for the purchase of plastics in

9.4 RECOMMENDATIONS

Overall, poor quality material delivered for recycling into Superwood products caused the Superwood project to fall short of its objectives. Tighter control on the quality of the materials shipped by municipalities for recycling is a top priority for any future endeavours in the production of post-consumer plastics recycled products. Downtime and equipment maintenance and repair costs were prohibited Superwood from achieving its first year objectives.

Marketing strategies were not transposable from Ireland to Canada causing some difficulty in getting the product into the marketplace, thereby increasing the product's visibility and ability to sell itself. Municipalities supplying plastics for production as well as other levels of government will be required to promote Superwood products, for their use, through changes in their procurement practices. This in turn promotes recycling by individuals with an end result that the amount of waste going to landfill will be reduced and all of the associated costs for transportation and disposal also reduced.

Canadian consumers are very traditional in their purchasing habits, especially in applications where Superwood is most suited. Greater public awareness through increased product visibility (i.e. more products available to be seen) is a necessity to effect a change in the buying habits. When this happens, there will be an increase Superwood's future potential.

FIGURE 7.1 (Cont'd) - SUPERWOOD ONTARIO: INCOME STATEMENT
(As at July 31, 1991)

	Year-To-Date	
	$	% Sales
Other Revenues and Expenses		
Bonus Income	50,000.00	26.7
Interest (Earned)	275.64	0.1
Interest Expense	9,998.48	5.3
Discount (Taken)	16.18	
Credit Given	1.58	
A/R Service Charges (Earned)	59.92	
Total - Other (Revenue)/Expense	(40,351.68)	(21.5)
Income (Loss) Before Taxes	(944,231.69)	(503.3)
Net Income or (Loss)	(944,231.69)	(503.3)

FIGURE 7.2 - SUPERWOOD ONTARIO LIMITED: BALANCE SHEET
(As at July 31, 1991)

	$	$	$	$
ASSETS				
Current Assets				
Cash on Hand				
Petty Cash	200.00			
Bank - TD A/C 0566 0915944	(310,151.91)			
Total - Cash on Hand		(309,951.91)		
Accounts Receivable				
Accounts Receivable - Trade	28,463.06			
Employee Advances - Misc.	300.00			
Net Accounts Receivable		28,763.06		
Inventory at Cost		(43,097.87)		
Prepaid Insurance		170.70		
Prepaid Deposits		14,194.84		
A/R - Provincial Grant		44,433.73		
A/R - Federal Grant		50,000.00		
Inter-Company Superwood B.C.		349,572.53		
Inter-Co. Superwood Quebec		201,193.27		
Inter-Co. Superwood New Bruns.		201.78		
Total - Current Assets			335,480.13	
Fixed Assets at Cost				
Automobile	17,648.09			
Accum. Dep'n-Automobile	5,492.74			
Net Book Value		12,155.35		
Office Furniture & Fixtures	7,825.90			
Accum. Dep'n-Furniture	1,340.93			
Net Book Value		6,484.97		
Machinery-Plant and Equipment	1,095,755.48			
Accum. Dep'n-Machinery	74,097.57			
Net Book Value		1,021,657.91		
Molds	99,660.00			
Computers	4,271.40			
Federal Grant	(200,000.00)			
Accum. Amort-Federal Grant	(21,659.00)			
Net Book Value		(74,409.60)		
Provincial Grant	(185,000.00)			
Accum. Amort-Prov. Grant	(20,039.50)			
Net Book Value		(164,960.50)		
Total - Fixed Assets			800,928.13	
Other Assets				
Deposits re. Equipment			1,717,485.00	
Total - Assets				2,853,893.26

FIGURE 7.2 (Cont'd) - SUPERWOOD ONTARIO LIMITED: BALANCE SHEET
(As at July 31, 1991)

	$	$	$	$
LIABILITIES & EQUITY				
Liabilities				
Current Liabilities				
Accounts Payable	523,621.54			
Employees' Income Tax Payable	3,635.99			
C.P.P. Payable	1,866.50			
U.I. Payable	2,664.82			
Employees' Workers Comp. Pble.	(5,759.10)			
Employees' Accrued Vacation	9,823.40			
Provincial Sales Tax Payable	1,279.04			
G.S.T. Collected	9,162.43			
G.S.T. Remittances/Receipts	60,510.44			
G.S.T. Input Credits	(222,886.64)			
Due to Shareholders	151,770.28			
Total - Current Liabilities		535,688.70		
Long-Term Liabilities				
Long-Term Debt				
Term Loan #1 (Tetra Pak)	600,000.00			
Working Capital Loan	250,000.00			
Expansion Advances - Tetra Pak	1,910,907.00			
Term Loan #2 (Tetra Pak)	557,318.21			
Total Long-Term Debt	3,318,225.21			
Unearned Income	247,318.59			
Total - Long-Term Liabilities		3,565,543.80		
Total - Liabilities			4,101,232.50	
Shareholders' Equity				
Share Capital				
Common Stock Issued	75,050.00			
Total - Share Capital		75,050.00		
Retained Earnings		(379,713.26)		
Current Earnings		(942,675.98)		
Total - Shareholders' Equity			(1,247,339.24)	
Total - Liabilities & Equity				2,853,893.26

inventory of $43,097.87.

7.2.3 Operating expenses

Table 7.1 outlines total operating expenses of $539,814.13. This figure incorporates all office and administration costs.

7.3 BALANCE SHEET

Table 7.2 is a Balance Sheet for the fiscal year ending 31 July 1991 for Superwood Ontario. It shows total current assets of $335,480.13. Total fixed assets including deposits on equipment equals $1,717,485.00. Total assets as at 31 July 1991 equal $2,853,893.26.

Current liabilities total $535,688.70. The long-term liabilities, which are primarily comprised of term loans and expansion advances from Tetra Pak, total $3,565,543.80. Total liabilities for Superwood at the end of the fiscal year is $4,101,232.50. Shareholders' equity and capital, reflecting retained earnings is $379,713.26 and current earnings of $942,675.98 result in a total of $1,247,339.24. Added together these figures represent the total liabilities and equity of this firm as being $2,853,893.26.

7.4 ECONOMIES OF SCALE

When the second extruder was added during the course of the year (not under the project but as a separate endeavour) at a cost of more than $360,000.00, the cost of production was not seen to appreciably increase. The president of Superwood reported that production costs increased only by about five per cent; this number reflected primarily the cost of electricity (Thane Cochran, 1991). No more staff was hired to operate the second extruder. As reported in chapter six, one of the limiting factors throughout much of the year in the production of Superwood products was the materials handling capability

of the shredder and its inability to provide enough plastic for the extruders. Once a shredder with increased capacity was purchased (at a cost of $54,000), the extruders were able to run for long periods without uninterruptions. The addition of the new equipment, enabled a doubling of production, was associated with an increase in production costs of approximately five per cent.

7.5 CAPITAL INTENSITY AND LEAD TIME TO PAYBACK

It can be seen from the Balance Sheet (Table 7.2) that the capital investment in the company requiring payback totals approximately $3.5 million. The present payback schedule for Superwood is based on a ten year amortization period covering the entire $3.5 million. This timeframe could be shortened if Superwood proceeds and is successful with the release of a $2.0 million public issue late in 1992. $1.5 million would be used to pay down the debt with the remaining $500,000 used as working capital.

8.0 MARKETING STRATEGIES FOR SUPERWOOD

8.1 MARKET REVIEW

Before the project was undertaken, a market review of the potential sales of Superwood recycled plastic products was conducted based upon statistical sources and contact with potential purchasers in identified market areas. Samples were shown to potential buyers and their reactions to the materials noted.

The markets reviewed, were in part a reflection of the areas in which the Irish manufacturer had found success. Superwood's success in Ireland had been impressive. In a market of 3.5 million people, Superwood has three extruders operating 24 hours per day, seven days per week, with an annual production of nearly 1,600 tonnes.

There are significant differences between the markets in Ireland and Ontario. In Ireland, competing wood product prices are higher, and highway signposts readily lend themselves to fabrication with Superwood. In Ontario, there is a major push to promote recycling, particularly of plastic, which is absent in Ireland. The price of Superwood products in Canada is also higher per kilogram, primarily due to higher labour and overhead costs.

A market survey for Superwood recycled plastic products was conducted in the following market areas:

* outdoor furniture (municipal uses, ie. picnic tables, benches, etc.)
* marina applications (docks, etc.)
* construction (fences, highway markers, sign posts, etc.)
* pallets

The survey revealed a wide and varied range of applications in which Superwood could provide significant user advantages over traditionally used materials - predominately wood. The diversity of uses provides a basic source of strength and flexibility in manufacturing added value and other products. The market categories recognized by the

TABLE 8.1: Market Prospects for Various Mixed-Plastic Products

MARKET	KEY CONSIDERATIONS	CONCLUSIONS
Boat docks	Extremely large existing market in NE. Continuous exposure to harsh wet environment. Plastic products currently used, accepted.	Strong potential.
Auto curb stops	Plastic currently used, cost effective. Colouring throughout saves maintenance costs. Lighter weight saves on labour costs.	Limited data available.
Breakwaters	Wet environment ideal for plastic.	Tight construction regulations; no large NE market.
Park benches	Continued exposure to inclement weather. Primary customers are gov'ts and schools.	Strong potential.
Mushroom trays	Moist conditions require plastic. Plastic products currently used.	Limited market data available; possible food-contact concerns
Horse stalls	Horses tend to chew top rail, forcing replacement. Bottom of stalls deteriorate forcing replacement. Large market in NY.	Strong potential.
Picnic tables	Manufacturing for government use done by prison system with subsidized lumber. Outdoor environment ideal for plastic.	Small market. Price supports rule out competitive position. Limited market data.
Playground equipment	Outdoor environment ideal for plastic.	Limited market data available.
Railroad ties	Excellent potential for recycled plastic. Potentially large replacement market.	Tight construction specs. Long-term strength & load-test results pending.

Source: Touche Ross, 1987, "Plastics Recycling Action Plan for Massachusetts".

survey were comparable to the nine categories of potential markets for mixed plastics analyzed by Touche Ross, Inc. (1987) in its report entitled, "Plastics Recycling Action Plan for Massechusetts". A summary of the Touche Ross (1987) report can be found in Table 8.1.

The survey revealed a wide and varied range of applications in which Superwood could provide significant user advantages over traditionally used materials - predominately wood.

8.2 ORIGINAL MARKETING STRATEGY

A review of each of the main market areas surveyed is provided, with summary estimates of market sizes, traditional materials used and comparative costs and expected market penetration in each area.

8.2.1 Marketing plan restrictions

It was noticed early that the market requested products of specific characteristics. Superwood adjusted the production to serve the immediate need. The limitation was the dimension of the existing moulds. The following models (moulds) were available:

1 inch x 3 inch x 96 inch
2 inch x 3 inch x 96 inch
2 inch x 4 inch x 96 inch
1 inch x 4 inch x 96 inch
1 inch x 6 inch x 96 inch
3 inch x 3 inch x 96 inch
2 inch diameter round x 96 inch
curbs 4.5 inch x 6 inch x 72 inch

It is not feasible for Superwood to buy a mould for a few products, therefore, a careful selection of dimensions was made to suit the majority of requests and orders.

Once the mould is acquired, there are possibilities to broaden the scope of the product range. Examples of such possibilities are the uses of different pigments in order to get various colours. Further, different additives may be blended (i.e., mica, silica) in order to produce a very light product or by using limestone powder or pelletized feedstock to get a more dense product.

Table 8.2: Superwood Market Quantity Projections: Third Year Level

MARKET	Superwood (lbs.)	Market Penetration(%)	Superboard (sq.ft)	Market Penetration(%)
As Pressure Treated Wood Substitute-general	1,100,000	<1%		
Pig Enclosures	100,000	25%	200,000	25%
Horses: Stall rails/ floors	100,000	2.5%	90,000	0.5%
Fencing	900,000	5.0%		
Municipal: Basic	22,000	50%	3,000	50%
Value Added	22,000	50%		
Docks	100,000	?	20,000	?
Pallets	170,000	0.1%	90,000	0.1%
Signs	50,000	?	40,000	?
Sundry	100,000		50,000	
Basic	2,422,000			
Value Added	242,000			
TOTAL	2,644,000		493,000	

8.3 COMPARATIVE CHARACTERISTICS AND CUSTOMER EXPECTATIONS

8.3.1 Substitute for Pressure Treated Timbers

One of Superwood's key advantages is its durability. Treated timbers are promoted as being extremely durable, with lifetimes in excess of 40 years claimed for pressure treated pine. When compared to pressure treated wood, the advantages of Superwood are:

* smaller cross section for the same strength in many applications
* availability of custom cross sections for special applications
* non-toxic, non-polluting
* recycled image
* availability in textured and coloured finish
* greater strength when subjected to impact (ie. will not shatter or splinter)
* potential longer lifetime

The greatest disadvantage of Superwood is the price. The price differential for the same dimensions is partly offset by the greater strength of Superwood, permitting smaller sizes to be used. The price differential would be lowest for the larger cross sections as Superwood is priced by the pound (or kilogram). At $0.60/lb. from the distributor, Superwood would be approximately 50% to 100% more expensive than pressure treated pine wood.

8.3.2 Docks

Docks are commonly made from wood. Preferred choices are pressure treated wood and cedar. The attraction of cedar is its durability, easy workability, lightness and pleasant smell. Typically, wood which is fully submerged or remains high and well drained lasts approximately 7-10 years. Superwood has the potential to replace cedar and other woods in some dock applications. Given the price premium required for Superwood, it is not likely that major inroads can be made into this market. It would be most attractive to commercial operators currently experiencing maintenance problems.

Private users appear to be prepared to accept some of the maintenance problems of wood in exchange for the aesthetic pleasures (e.g. smell, look). Superwood large members below the deck surfaces may have appeal because of the longer life in a difficult wet/dry environment.

Superwood, being plastic may not be viewed in a positive light in a "get-away-from-it-all", rustic, cottage environment. For a further review of the potential of recycled plastics in marine applictions refer to the Fisheries and Oceans report, "Recycled Plastic: The Feasibility of its Application in Marine Structures", by A.G. Rooney, 1991.

8.3.3 Highway markers and signs

In Ontario, signs are most commonly mounted on pressure treated pine posts. Where the provincial or local government agencies specify the post material to be used, it is possible that procurement policies, once developed, that are aimed at promoting recycling, could favour the use of Superwood, even at a premium price. The Superwood posts, if broken off, could easily be returned to Superwood for re-recycling, thereby enhancing the environmental position of the product.

8.3.4 Municipal applications

Municipalities are a major supplier of waste plastic material for recycling. The primary motive is waste disposal cost avoidance. For this reason, they have a vested interest in ensuring the success of recycling initiatives that make use of their recovered plastic material. There is also some political gain to be made in using materials made from waste plastic in high visibility public uses.

Some municipalities in the Toronto Area have formed a GIPPER Committee to encourage internal purchasing to acquire products made from recycled materials.

Superwood is more resilient to vandalism and would reduce maintenance costs associated with the use of wood. Again, broken materials can be returned for re-recycling.

Discussions with municipal purchasing officers indicated that the range of Superwood applications could include the following:

* park benches
* picnic tables
* some advertising and display kiosks
* tree stakes
* survey stakes

8.3.5 Animal enclosures

Pens for pigs and stalls for horses and cows traditionally have been made from wood-based products. Wood has a large disadvantage over Superwood in durability. Horses in stalls often chew on wood surfaces within easy reach. The top rail is particularly vulnerable. The bottom rail also deteriorates more rapidly due to moisture exposure and kicking. Superwood is highly resistant to animal chewing and damage due to animal droppings and urine. If it is as resistant as expected, the premium in excess of wood could be easily justified.

In flooring applications in agriculture, Superwood (Stokboard) could be used in exchange of concrete or wood. Concrete acts as a heat sink, thereby increasing the requirements for bedding. Superwood would not incur this difficulty. Wood floors have a tendency to wear out quickly. Again Superwood's resistant nature would decrease maintenance on such floors.

Fencing products is where the greatest application of Superwood could occur. Where wood fences are used, concern for pressure treated wood chemicals means that owners generally use untreated wood. Wooden fences are considered aesthetically desirable, with the preferred finish in white paint. However, the cost of maintenance is high, in both time and paint. Wood fences would also be subjected to chewing by livestock decreasing time between replacement.

Superwood could be used to replace both the posts and the rails since its weathering characteristics and resistant nature make it a reasonable replacement material.

8.3.6 Pallets

Superwood and Superboard can be used to make pallets. Pallets of these materials would be more resistant to damage from impact by fork-lift trucks and rough handling than conventional wood pallets. Tests were done on the Superwood pallets by Forentec Ottawa. The expected lifespan of a Superwood pallet would be at least twice that of a wood pallet. As well, plastic pallets would be particularly appropriate for use in industries where toxic or corrosive chemicals are used. The pallets are resistant to chemicals and are non-absorbent to stains due to oils, etc.

The cost of the pallets is about double the cost of conventional wood pallets. The use of Superwood pallets is attractive only where pallet costs are very small relative to product value, where cleanliness or safety is paramount or where there are very high replacement rates or where it is possible to establish a controlled distribution and return system. The cost differential is justified by the longer lifespan and ability to maintain cleanliness and safety.

8.3.7 Other uses

Other uses identified for future assessment include

* acoustic screening
* panels for fabricated items
* truck bed liners
* wall and floor protection
* cladding for containers
* railway boxcar liners
* anti-vibration transmission bases for machinery
* partitioning (e.g. office and automotive industry)
* formwork for concrete, particularly curved work or for reused framework requiring cleaning
* formation or lining of leakproof vessels and containers

* structural material in sewage treatment plants, chemical or other corrosive environments
* raised walkways for use in factories or outdoors where work areas are constantly or frequently wet.

The addition of more moulds, colours and processing additives (to change the densities of the Superwood) will increase the marketable applications of Superwood.

8.4 FUTURE MARKETING PLANS

Historically, Superwood Ontario has concentrated sales efforts on retail markets having a need for picnic tables, benches, flower boxes and garden lines. In April 1991, the company hired sales person to commence marketing to the pallet industry, and another sales person to direct efforts to all other markets. Previous market analysis had indicated potential demand in a broad spectrum of markets from marine to agriculture, and the properties of the product indicated a wide variety of applications.

Specific uses of the product has indicated several physical properties of Superwood such as softening, warping and surface consistency, which suggest that a redirection of marketing programme was advisable. Generally, Superwood has been identified as ideal for:

* non-visual applications
* high breakage use
* low maintenance
* hygienic substitution
* other applications requiring high volume with long production runs

Superwood currently acquires 90 per cent of its raw material from Blue Box collection programmes. It is the company's strategy to continue to focus in this direction for materials acquisition. Considering this source, a substantial market should be created in these areas. Municipalities are avoiding the costs of disposal of this material and should be encouraged to help support the recycling of plastics through their materials

requisitioning requirements and close the loop.

Since the company has a need for high volume sales and must compete at this stage on a benefits basis as opposed to price, marketing and sales efforts will be focused on industrial and government applications which meet these criteria. The company will concentrate on high volume gross product use only, where the same marketing material can be used. This will also prevent the sales efforts from "wandering".

8.4.1 Markets

Superwood will focus marketing efforts in the future on:

INDUSTRIAL

* pallets
* truck liners
* rail car liners

CONSTRUCTION

* concrete forming
* curbs, etc.

AGRICULTURE

* general farm use

GOVERNMENT

* the company will develop a programme of mandatory purchasing by raw materials suppliers,
* other agencies including: Defence, Agriculture, etc.,
* non-stress uses such as kerbs, boxes, etc.

DISTRIBUTORS

* Currently Superwood Ontario has three retail distributors fabricating finished

products for retail and commercial purchasers. In order to keep Superwood out of the fabricating business, Superwood plans on developing a network of small distributors with non-exclusive agreements.

* The potential for large national distributors of lumber substitutes exists if companies such as Lansing Building Supply and Beaver Lumber can be sold on the benefits of the products.

A Marketing and Sales Manager was recently hired to help focus the marketing share along with increased product awareness. This should result in higher, more stable sales and longer, more economic production runs. Time and effort are required. To date, over nine months have been spent developing contacts and working on product specifications for the pallet industry. Long lead time sales efforts are required to have decision makers choose Superwood products instead of some traditional materials.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 MEETING THE OBJECTIVES

The first twelve months of operation were very much a learning period. The equipment purchased by Superwood had never run post-consumer plastic as a steady feedstock. Superwood in Ireland had done some trials with clean mixed plastics but had no experience with plastics contaminated as those supplied to Superwood Ontario.

Mississauga was the first municipality to expand its recycling programme to include all plastics. Other municipalities were collecting only clean rigids (i.e. PET bottles and HDPE milk jugs). Consequently, little was known about collection volumes contamination levels or types of plastics collected.

The manner in which the collection contractors collected the plastic caused heavy contamination of glass and paper. The truck drivers are under pressure to complete their routes and as a result are unable to carefully check the contents of the plastic bags put out at the curb. When the plastics arrived at the main depot, they were presumed by the collection company to be sorted and clean and ready to bale.

The amount of plastic received at the Superwood facility is more than ten times the projected figure since Mississauga added forty thousand households to the collection routes. This has placed a tremendous strain on the materials flow systems and as a result, huge stockpiles of plastics are stored at the facility and all over the province.

The contamination levels encountered wore the extrusion equipment much more quickly than would be expected using virgin plastics. The resultant downtime has set back production schedules and caused Superwood to abandon original marketing plans. Because of the poor quality of the incoming material, quality control was very difficult. To compensate, more equipment has been installed and Superwood reluctantly began rejecting loads of mixed plastics.

9.2 SUPERWOOD'S POTENTIAL IN CANADA

Superwood's original assessment of the Canadian market was based on the Irish company's sales experiences. This assessment proved to be flawed. Canadian climatic conditions and insistence on higher quality and 'natural' products has made the Canadian market much different. Superwood has had to adapt and change its marketing strategy accordingly.

Mississauga had promised to purchase Superwood products for use in the City. Purchasing orders did not materialize as expected. In the future, Superwood's policy is that plastics will not be accepted by the facility unless a secured arrangement for the purchase of some of the Superwood products is in place.

9.3 FUTURE PLANS

All levels of government are being lobbied to "close the loop" in recycling. Procurement practices will have to be altered to allow for the purchase of Superwood products until Superwood is universally accepted for use by the general public. Their purchase of Superwood products would also promote recycling of plastics through a high visibility role. Superwood anticipates that this process will take three to five years to implement and complete.

In the short term, Superwood is concentrating business on high volume repetitive business, primarily with "blue chip" corporations. These type of customers are sold more on the quality and cost effectiveness of the product rather than the environmental benefits associated with such a purchase.

There also is a possibility of a future amalgamation of Superwood Ontario with Superwood Western, a separate, privately owned producer of Superwood products, based in Edmonton, Alberta.

9.4 RECOMMENDATIONS

Overall, poor quality material delivered for recycling into Superwood products caused the Superwood project to fall short of its objectives. Tighter control on the quality of the materials shipped by municipalities for recycling is a top priority for any future endeavours in the production of post-consumer plastics recycled products. Downtime and equipment maintenance and repair costs were prohibited Superwood from achieving its first year objectives.

Marketing strategies were not transposable from Ireland to Canada causing some difficulty in getting the product into the marketplace, thereby increasing the product's visibility and ability to sell itself. Municipalities supplying plastics for production as well as other levels of government will be required to promote Superwood products, for their use, through changes in their procurement practices. This in turn promotes recycling by individuals with an end result that the amount of waste going to landfill will be reduced and all of the associated costs for transportation and disposal also reduced.

Canadian consumers are very traditional in their purchasing habits, especially in applications where Superwood is most suited. Greater public awareness through increased product visibility (i.e. more products available to be seen) is a necessity to effect a change in the buying habits. When this happens, there will be an increase Superwood's future potential.

APPENDIX A:
SUPERWOOD ONTARIO DEMONSTRATION PROJECT
TERMS OF REFERENCE

Science Branch
12C1 Phase III
Place du Portage
Hull, Quebec K1A 0S5

CONTRACT - CONTRAT

You are requested to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the supplies and services listed herein and on any attached sheets at the price or prices set out thereof.

Nous vous demandons de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans les présentes et aux annexes ci jointes, les articles et les services énumérés dans les présentes et sur toute feuille ci annexée, au(x) prix indiqué(s)

The vendor hereby accepts this contract - Le fournisseur accepte le présent contrat

Name, title of person authorized to sign (type or print)
Nom et titre du signataire autorisé (caractère d'impression) Signature Date

Return signed copy forthwith - Prière de retourner une copie dûment signée immédiatement

SUPERWOOD ONTARIO LIMITED
2430 LUCKNOW DRIVE, UNIT 1
MISSISSAUGA, ONTARIO
L5S 1V3
ATTN: T.J. COCHRAN

SSC file No. - N° de référence d'ASC
048SZ.KE144-0-6026

Date of Contract - Date du contrat
26 Mar 1990

Contract No. - N° du contrat
KE144-0-6026/01-SZ

Requisition No. - N° de la demande

Order office Bureau demandeur	Yr An	Serial No. N° de série
KE144	0	6026

Financial Code(s) - Code(s) financier(s)
89 2054-2200-66900-113-

Duty - Droits
See herein

F.O.B - F.A.B.
Destination

Federal Sales Tax - Taxe de vente fédérale
See herein

Destination
G. HILL
ENVIRONMENT CANADA C & P
TECHNOLOGY DEV.& TECH.SERV.BR.
351 ST-JOSEPH BLVD. - 12TH FL.
HULL, QUEBEC K1A 0H3 953-1196

Invoices - original and two copies are to be made out and sent to:
Factures - remplir et envoyer l'original et deux copies à
SEE HEREIN

Address enquiries to: - Adresser toute demande de renseignements à
L. Pedersen

Area code code régional	Telephone No N° de téléphone	Extension Poste	Telex No N° de télex
819	956-1688		053-3703

Total est cost - Coût total est
$200,000.00

For the Minister - Pour le Ministre

DSS-MAS 9400-10 (07/88)

REQUEST FOR PROPOSAL AND CONTRACT FOR PROFESSIONAL AND RESEARCH AND DEVELOPMENT SERVICES

A. INSTRUCTIONS:

1 This is a request hereinafter referred to as a Request for Proposal or RFP) that proposals be developed and submitted to the Minister of Supply and Services setting out the alternative means by which several technical performance time and other goals and objectives may be best met having regard to stated mandatory requirements. The Minister will consider entering into contract for the implementation of the most acceptable proposal which will be determined having regard to the evaluation factors set out in this RFP. In addition the proposal will be measured against the contract terms and conditions set forth in this RFP.

2 a) To submit your proposal return signed original of this form duly completed, using the enclosed envelope. Ensure that your firm's name, SSC number, RFP closing date and time appear in window of return envelope. Do not use this envelope for enquiries. Proposals submitted by telegraphic means are acceptable provided they are received prior to the time specified for closing of proposals and contain the proposal reference number and closing date. Telegraphic proposals will constitute your formal proposal. Such proposals must be comprehensive and in sufficient detail so as to permit complete evaluation in accordance with the criteria set out herein. The Minister may consider entering into contract without negotiation on the basis of such telegraphic proposal.

b) The bidder has the sole responsibility for the timely dispatch and delivery of a bid and cannot transfer such responsibility to the Crown.

3 Proposals may be accepted in whole or in part and the lowest or any proposal will not necessarily be accepted. In case of error in the extension of prices, the unit price will govern. Proposals will remain open for acceptance for a period of not less than sixty days from closing date of this RFP, unless otherwise indicated herein by SSC. All late proposals will be returned unopened. Proposals mailed at least forty-eight hours prior to the closing time and date (96 hours outside Canada) and are delayed in the mail, will be considered providing evidence of timely mailing is supported by certification of registered mail special delivery or by postage cancellation. (Note: postage meter imprints are not acceptable as proof of timely mailing.)

4 Offers are based on the specified payment period. Payment may be made in advance of the due date set out under the payment terms of the contract/purchase order/standing offer where the supplier's invoice offers a discount for early payment and the discount at least offsets the cost to the government of paying early. For this purpose the costs to be considered are:

- imputed interest at the 3 month Treasury Bill rate plus ½ of 1 percent for the number of days that payment is made early, and
- the incremental cost to the government of any special processing that may be required.

Cash Discounts for early payment will not be considered in the evaluation of bids.

B. CONDITIONS

Unless otherwise stated herein, all proposals and any contracts resulting therefrom are subject to General Conditions for Contract, Short Form DSS MAS 9076 (copy of which the bidder acknowledges to have received) and the following:

1 a) Excluding the exceptions noted below, the contractor shall not invoice or collect any ad valorem sales tax levied by the province in which the goods or taxable services are delivered to federal government departments and agencies under authority of the following provincial sales tax licences:

Newfoundland	32243-0 09	Quebec	Q-398-SS-3921-1-P
Prince Edward Island	OP 10000 250	Ontario	11708174G
Nova Scotia	U84 00-03172 3	Manitoba	390516-0
New Brunswick	P87-60 01648	British Columbia	005521

b) Exceptions

(1) petroleum products subject to provincial gasoline and motive fuel taxes;

(2) tobacco products;

(3) prepared meals and transient living accommodation;

(4) broadcast advertising services (Quebec, Newfoundland) and all other advertising in Newfoundland;

(5) amusement and/or entertainment taxes.

c) In Alberta and Saskatchewan provincial retail sales taxes do not apply to goods or taxable services delivered to the federal government under this contract.

d) The contractor is not relieved of any obligation to pay provincial sales taxes on goods or taxable services used or consumed in the performance of this contract including materials incorporated in real property.

2 If transportation charges are payable by Her Majesty under the terms of this contract, shipments are to be made by the most direct and economical means consistent with normal shipping practice, unless otherwise directed. They are to be shown as a separate item on the invoice.

3 Valuation. The federal government's policy of underwriting its own risks precludes payment of any excess valuation and or transportation charges beyond the specified FOB point (the point at which title of goods passed to the federal government). Goods will be covered to the carrier's maximum liability and value will be declared only when additional costs will not be incurred.

4 The work is subject to inspection and acceptance at destination unless otherwise specified herein.

DEMANDE DE PROPOSITIONS ET CONTRAT PORTANT SUR DES SERVICES PROFESSIONNELS ET DE RECHERCHE ET DÉVELOPPEMENT

A. DIRECTIVES:

1 La présente constitue une demande (nommée dans les présentes Demande de propositions ou DP) concernant la mise au point et la présentation, au Ministre des Approvisionnements et Services, de propositions indiquant d'autres moyens d'atteindre le plus efficacement possible certains objectifs techniques, de performance, de temps et autres en ce qui a trait aux exigences obligatoires indiquées. Le Ministre envisagerait d'accorder un contrat pour la mise en oeuvre de la proposition la plus acceptable, en rapport avec les facteurs d'évaluation indiqués dans la présente DP. De plus, les conditions contractuelles aux termes desquelles le soumissionnaire accepterait d'entreprendre la mise en oeuvre de la proposition sont mesurées en fonction des conditions contractuelles indiquées dans la présente DP.

2 a) Pour soumettre votre proposition, veuillez retourner à l'aide de l'enveloppe ci-jointe, l'original de la présente formule dument complétée et signée. Veuillez vous assurer que le nom de votre compagnie, le numéro d'ASC et la date et l'heure de clôture de la DP soient visibles dans la fenêtre de l'enveloppe de retour. Prière de ne pas utiliser cette enveloppe pour des demandes de renseignements. On accepte les propositions télégraphiées à condition qu'elles parviennent avant l'heure de clôture des propositions. Elles doivent comprendre le numéro de référence de la proposition et la date de clôture. De telles propositions constitueront des propositions formelles, elles doivent être complètes et suffisamment détaillées pour permettre une évaluation conforme à tous les critères indiqués dans les présentes. Le Ministre peut envisager de passer un marché sans négociation sur la foi d'une telle proposition faite par télégramme.

b) Le soumissionnaire est seul responsable de l'envoi et de la livraison à temps de sa soumission. Cette responsabilité ne peut en aucun cas incomber à la Couronne.

3 Les propositions peuvent être acceptées en entier ou en partie et aucune proposition qu'il s'agisse ou non de la moins disante, ne sera nécessairement acceptée. En cas d'erreur dans le prix global, les prix unitaires feront foi. En vue de l'acceptation, les propositions resteront valables pendant une période d'au moins soixante jours à compter de la date de clôture de la présente DP, à moins d'avis contraire indiqué dans les présentes par l'ASC. Toutes les propositions reçues en retard seront retournées sans avoir été ouvertes. Les propositions postées au moins quarante-huit heures avant la date et l'heure de clôture (96 heures à l'extérieur du Canada) et qui sont retardées par la poste seront examinées, à condition qu'il soit prouvé à l'aide d'un reçu de courrier recommandé ou de livraison spéciale ou par le cachet d'oblitération qu'elles ont été postées à temps. (Remarques : Les impressions de machines à affranchir ne constituent pas une preuve d'envoi postal.)

4 Les offres sont basées sur le délai de paiement spécifié. Le paiement peut être effectué avant la date d'échéance stipulée dans le contrat/la commande/l'offre permanente trayer les mentions inutiles) si le fournisseur offre un escompte de caisse qui compense le coût du paiement anticipé pour le gouvernement. A cet égard, les coûts à prendre en considération sont les suivants :

- les intérêts théoriques au taux des bons du Trésor à trois mois, plus ½ de 1% par jour d'anticipation;
- le coût marginal supporté par le gouvernement, de tout traitement spécial nécessaire.

Les escompes de caisse en considération dans l'évaluation des soumissions.

B. CONDITIONS

A moins d'indication contraire dans les présentes, toutes les propositions et les contrats qui en découlent sont assujettis aux Conditions générales portant sur les contrats (formule abrégée DSS MAS 9076 (dont le soumissionnaire reconnaît avoir reçu copie)) ainsi qu'aux critères suivants :

1 a) Sauf pour les exceptions notées ci-dessous, l'entrepreneur ne doit pas facturer ou percevoir la taxe de vente ad valorem qui est perçue par la province dans laquelle les biens ou les services imposables sont livrés ou fournis aux ministères et organismes fédéraux en vertu des licences provinciales suivantes :

Terre Neuve	32243-0-09	Québec	Q 398 SS 3921 1 P
Ile-du Prince Edouard	OP 10000 250	Ontario	11708174G
Nouvelle Ecosse	U84-00-03172-3	Manitoba	390516-0
Nouveau Brunswick	P87-60 01648	Colombie-Britannique	005521

b) Exceptions

(1) produits pétroliers assujettis aux taxes provinciales sur l'essence et le carburant à moteur;

(2) les produits du tabac;

(3) les repas préparés et les logements de transit;

(4) les services de publicité électronique (Québec/Terre Neuve) et toute autre forme de publicité à Terre Neuve;

(5) les taxes sur les divertissements ou les spectacles.

c) En Alberta et en Saskatchewan, les taxes provinciales de vente au détail ne s'appliquent pas aux biens ou aux services imposables livrés ou fournis au gouvernement fédéral au titre de ce contrat.

d) L'entrepreneur n'est pas dispensé de l'obligation de payer la taxe de vente provinciale sur les biens et les services imposables utilisés ou consommés durant l'exécution de ce contrat, y compris les matériaux incorporés dans des biens immobiliers.

2 S'il incombe à Sa Majesté d'assumer les frais de transport aux termes du présent contrat, les biens devront être expédiés de la façon la plus directe et la plus économique possible selon les modes d'expédition normaux, à moins d'indication contraire. Ces frais doivent faire l'objet d'une rubrique à part sur la facture.

3 Evaluation : La politique du gouvernement fédéral qui consiste à assurer ses propres risques exclut le paiement de toute évaluation excédentaire et de frais de transport en plus des frais indiqués qui sont FAB à destination (la destination à laquelle le gouvernement fédéral a pris possession des biens). Les biens seront protégés aux taux d'assurance maximal du transporteur et leur valeur ne sera déclarée que si des frais supplémentaires ne sont pas engagés.

4 Les travaux sont sujets à l'inspection et à l'acceptation au point d'arrivée, à moins que d'autres dispositions ne soient précisées à cet effet dans les présentes.

TITLE: DEMONSTRATION OF A TECHNOLOGY TO
***** RECYCLE MIXED PLASTIC WASTES RECOVERED
FROM THE SOLID WASTE STREAM
(PART OF THE DEVELOPMENT AND
DEMONSTRATION OF RESOURCE AND ENERGY
CONSERVATION TECHNOLOGY PROGRAM - DRECT)

DELIVERY DATE: March 31, 1991
****

STATEMENT OF WORK
****
The Contractor shall perform the work in accordance with Appendix "A" attached hereto and forming part of this contract and also in accordance with the Contractor's technical proposal, dated June 1989, submitted to Environment Canada under the DRECT Program.

PRIORITY OF DOCUMENTS:
****
The documents listed below form part of and are incorporated into this contract. If there is a discrepancy between the wording of one document from the wording of any other document which appears on the list, the wording of the document which first appears on the list shall prevail over the wording of any document which subsequently appears on the list:

1) these articles of agreement
2) General Conditions DSS 9224 (as amended)
3) Appendix "A" - Statement of Work
4) Appendix "B" - Report Requirements for DRECT Program
5) Appendix "C" - Contract Plan & Report Form
6) Appendix "D" - Deliverable Items and Documents
7) Appendix "E" - Outline of Costs and Charges

DELIVERABLES
****
The Contractor shall deliver to the Scientific Authority at the place and time designated therein, the following:

- those Deliverables as specified in Appendices "A" and "D", attached hereto.

The Contractor shall notify the Science Branch Contracting Officer, in writing, that the above-noted items have been delivered as required.

INSPECTION/ACCEPTANCE:
****
All the work performed under the Contract shall be subject to inspection by the Scientific Authority, designated herein, prior to acceptance. Should the work or any portion thereof not be in accordance with the

requirements of the contract, the Scientific Authority shall have the right to reject it or require its correction.

SCIENTIFIC AUTHORITY:
****
D. Hutchison
Conservation and Protection
Environment Canada
351 St.-Joseph Blvd., 12th Floor
Hull, Quebec
K1A 0H3 TELEPHONE: (819) 953-1196

The Scientific Authority is responsible for all matters concerning the scientific and technological content of the work under this contract. Any proposed changes to the scope of the work are to be discussed with the Scientific Authority, but any resultant changes can only be authorized by a contract amendment issued by the Science Branch Contracting Officer.

SCIENCE BRANCH CONTRACTING OFFICER:
****
Larraine Pedersen, P.Eng.
Senior Science Procurement Officer
Science and Professional Services Directorate
Supply and Services Canada
12C1 Place du Portage - Phase III
11 Laurier Street
Hull, Quebec
K1A 0S5 TELEPHONE: (819) 956-1688

The Science Branch Contracting Officer named above is responsible for the management of this contract and any changes to the contract must be authorized by a formal contract amendment issued by that officer. The Contractor is not to perform work in excess of or outside the scope of this contract based on verbal or written requests or instructions from any government personnel other than the aforementioned officer.

BASIS OF PAYMENT:
****
In consideration of the Contractor satisfactorily completing all of its obligations under this contract, the Contractor shall be paid a firm price of $200,000.00, FOB Hull, Federal Sales Tax N/A .

LIMITATION OF EXPENDITURE:
****
No increase in the total liability of Her Majesty or in the price of the work or services resulting from any design changes, modifications or interpretations of the specifications will be authorized or paid to the Contractor unless such design changes, modifications or interpretations shall have been approved by this Department prior to their incorporation in the work.

METHOD OF PAYMENT
****

After acceptance by EnCan/DSS of the applicable deliverables, milestone payments will be made up to 100% of the amount claimed in accordance with the following:

	FIRM AMOUNTS
Milestone 1	$125,000
Milestone 2	25,000
Milestone 3 (Final Report)	50,000
TOTAL FIRM AMOUNT	$200,000

provided that:

an original and three (3) copies of the Contractor's claim on Form DSS 1111 are to be submitted to the Science Branch Contracting Officer.

Payment by Her Majesty to the Contractor for the work shall be made:

(a) In the case of a progress payment other than the final payment, within thirty (30) days following the date of receipt of a duly completed Progress Claim, form DSS 1111;

(b) In the case of a final payment, within thirty (30) days following the date of receipt of a duly completed final Progress Claim, form DSS 1111, or within thirty (30) days following the date on which the work is completed, whichever date is the later;

(c) If Her Majesty has any objection to the form of the progress claim, within 15 days of its receipt, She shall notify the Contractor of the nature of the objection. "Form of the claim" means a claim which contains or is accompanied by such substantiating documentation as Her Majesty requires. Failure by Her Majesty to act within 15 days will only result in the date specified in sub-paragraphs a) and b) of the clause to apply for the sole purpose of calculating interest on overdue accounts.

INTEREST ON OVERDUE ACCOUNTS:

(a) (i) In this Article an amount is "due and payable" when it is due and payable by Her Majesty to the Contractor according to the terms of the contract.

(ii) For the purposes of this Article, an amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

(iii) In this Article "date of payment" means date of the negotiable instrument drawn by the Receiver General for Canada and given for payment of an amount due and payable.

(iv) in this Article "Bank Rate" means the discount rate of interest set by the Bank of Canada.

(b) (i) Her Majesty shall be liable to pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 1/4 per centum on any amount which is overdue from the day such amount became overdue until the day prior to the date of payment, inclusively; however, interest will not be payable nor paid unless the amount has been outstanding (unpaid) for more than 15 days following the due date. Interest will not be payable on overdue advance payments.

(ii) The Bank Rate shall be that prevailing at the opening of business on the date of payment.

(c) Interest shall only be paid when Her Majesty is responsible for the delay in paying the Contractor. In the event Her Majesty is not responsible for the delay in paying the Contractor, no interest shall be paid.

CONDITIONS PRECEDENT TO PAYMENT:
****
No payment shall be made to the Contractor unless or until:

a) invoices, inspection notes and all other documents prescribed from time to time by the Minister or inspector are submitted in accordance with the terms of the contract or instructions of the Minister;

b) with respect to all materials, parts, work in process or finished work, the cost of which has been paid by the Contractor and in respect of which payment is being made by the Minister, the Contractor, if required to do so, establishes to the satisfaction of the Minister that the materials, parts, work in process or finished work are free from all claims, liens, attachments, charges or encumbrances;

c) with respect to all materials, parts, work in process or finished work, the costs of which have accrued in the accounts of the Contractor as a liability to be discharged in the normal course of business and in respect of which materials, parts, work in process or finished work payment is being made by the Minister, the Contractor, if required to do so, establishes to the satisfaction of the Minister that it is not, in the ordinary course of business, delinquent in discharging its accrued liabilities arising from the performance of the contract and that the payment to be made by the Minister shall be used only for the purpose of discharging such liability and that upon such discharge the materials, parts, work in process or finished work shall be free from all claims, liens, charges or encumbrances; and

d) in the case of payment in respect of finished work, such finished work has been inspected and accepted in accordance with the terms of this Contract.

GENERAL CONDITIONS:
****
General Conditions Research and Development DSS 9224 (8/84), a copy of which is

attached, shall apply to and form part of this contract. The General Conditions referred to on the reverse of Page 1 are not applicable.

The following modifications are made to General Conditions Research and Development, Form DSS 9224 (8/84):

i) Conduct of the Work: Part 2, Article 7 of the Terms and Conditions DSS 9224 is hereby supplemented by adding the following subsection:

(5) The Contractor shall not stop or suspend work pending the settlement or determination of any differences arising under the contract, unless so instructed by the Minister.

ii) Subcontracts: Article 11 of the Terms and Conditions DSS 9224 is hereby supplemented by adding the following sentence to subsection (1):

For work requiring consent, should the Contractor propose to solicit bids from other than Canadian sources he shall obtain the consent in writing of the Minister prior to solicitation.

iii) Termination, Suspension, Change: Paragraph (b) of subsection 2 of Article 21 of Terms and Conditions 9224 is deleted in its entirety and the following is substituted therefor:

(b) the Work or any portion of the Work is terminated, the Contractor shall be paid for all finished deliverables, delivered and accepted and for all materials or work-in-process delivered and acceptable to Her Majesty, the Cost to the Contractor in accordance with the terms of the contract plus the proportional part of any fee applicable hereto. The Contractor shall also be entitled to be reimbursed its costs which are incidental to the cancellation of obligations incurred by the Contractor pursuant to the termination notice, the cost of preparing the necessary accounts and statements with respect to the Work performed to the effective date of such termination and commitments made by the Contractor with respect to the terminated portion of the Work, wages which the Contractor is obliged under any laws or regulations for the time being in force, to pay employees whose services are no longer required by reason of such termination, the costs of and incidental to the taking of any inventory of materials, components, work-in-process and finished work on hand at the effective date of the termination and other costs and expenses of and incidental to the termination in whole or in part, of operations under the Contract;

provided always that payment and reimbursement under the provisions of this sub-section shall be made only to the extent that is established to the satisfaction of the Minister that the said costs and expenses were actually incurred by the Contractor and that the same are reasonable and are properly attributable to the termination of the Work or the part therof so terminated.

(c) In no event shall the aggregate of the price paid to date and the amounts payable pursuant to this Article exceed the total Contract Price.

(d) The Contractor shall have no claim for damages, compensation, loss of profit, allowance or otherwise by reason of or directly or indirectly arising out of any action taken, or notice given by the Minister under or pursuant to the provisions of this Article except as and to the extent in this Article expressly provided.

In addition:

Clauses 12, 13 and 14 are replaced by the following:

In accordance with the detailed terms listed below, the Contractor shall retain ownership and control of all physical assets on completion of the contract;

(1) Title to all designs, technical data, drawings, plans, reports and other information and things produced by the Contractor in carrying out the contract shall vest in and remain the property of the Contractor, subject to the provisions of sections (2), (3) and (4) hereof.

(2) The Contractor shall retain title to all inventions, methods or processes conceived or developed in carrying out the contract and may apply for patent thereof upon the following conditions:

(a) that no royalties on such patents will be charged Her Majesty where any supplies embodying such patented inventions are procured by Her Majesty; and

(b) that the Contractor shall not sell, assign, transfer, license or give to other governments or to any person, company, partnership or firm outside of Canada, any technical information, data, design or inventions (whether or not patented) resulting from the contract, without obtaining the prior written consent of the Minister.

(3) Her Majesty shall have the free use of all technical information and data resulting from the work, including the right to disseminate such technical information and data for information purposes only, which includes the right to edit and publish any

arising out of such termination.

(6) The Contractor agrees to bind each the terms of this clause.

CONFLICT OF INTEREST:
****
It is a term of this contract that no former public office holder who is not in compliance with the post-employment provisions of the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

DISCRETIONARY AUDIT:
****
Those costs incurred by the Contractor under the contract are subject to verification by Government audit, at the Minister's discretion, before or after payment is made under the terms and conditions of the contract. If the said audit demonstrates that the Federal share of the total costs exceeds 50%, then it is agreed that the Contractor shall make prompt repayment to the Crown of the amount found to be in excess of 50%. For the purpose of the audit, costs will be determined in accordance with the outline of Costs and Charges attached hereto as Appendix "E". Profit is not allowable on a DRECT project.

information contained in the report.

(4) Whenever the Contractor elects not to apply for a patent covering an invention conceived or developed hereunder, Her Majesty may apply for and obtain such patent in the name of Her Majesty.

If the Contractor sells or transfers to commercial use any prototype, pilot plant or other equipment prior to completion of this contract, the costs of which were charges to the DRECT program, the Contractor may be required, at the discretion of the Minister or his delegated representative, to repay to the Crown, in the ratio of their respective contribution, the proceeds of sale or the fair market value of the prototype, pilot plant, materials, or equipment, whichever is greater, but the Crown's share shall not exceed the Crown's contribution to the project. Furthermore, in this case, any revenue gained during the period of the contract will be deducted from the remainder of the Crown's contribution.

The Contractor must be willing and able to make available within Canada, at reasonable cost, to all interested industry, government and private sectors, any of the patents or the process technology developed with the assistance of the DRECT program. Where the manufacture of specialized equipment is involved, the Crown will have royalty-free access to the equipment, for its own use.

SOUTH AFRICAN CONDITION:
****

(1) Subject to subsection (2), the Contractor shall ensure that, to its knowledge, the goods and services to be provided pursuant to this contract are neither of South African origin nor obtained from a company that is majority-owned (51 percent of the voting rights) by South African interests.

(2) Where the Contractor is aware that goods or services of South African origin or obtained from companies that are majority-owned by South African interests are to be supplied in connection with a resulting contract, the Contractor shall identify the items involved, the estimated total value of the goods and services, and the justification for their use.

(3) Following a review of the Contractor's justification, the Minister may accept or reject the justification, at the sole discretion of the Minister.

(4) Where the Minister rejects the Contractor's justification, the Minister may terminate the contract in accordance with subsection (5).

(5) The Contractor agrees that the Minister relies upon subsections (1) and (2) to enter into this contract and any breach of subsection (1) or (2) shall entitle the Minister to terminate this contract for default and to recover from the Contractor damages, including reprocurement costs

APPENDIX " A "

Statement of Work

Objective

The overall objective of this project is to demonstrate, using a plastic recycling machine built by Superwood Holdings PLC of Ireland, that a saleable, competitively-priced product can be produced from mixed plastic wastes obtained primarily from the Mississauga "blue box" curbside recycling program. Commercial feasibility of the new technology will be considered sound with the achievement of the following objectives:

1. To install and operate a full-scale Superflow Jumbo Moulding Machine for a period of three consecutive months at the rated capacity of 200-250 kilograms per hour.

2. Over a three month period, to process 255 tonnes of mixed plastic waste obtained primarily from the Mississauga blue box curbside recycling program, using the Superflow Jumbo Moulding Machine, to produce 255 tonnes of marketable products. The process will have no byproducts, emissions, or discharges that cause a negative impact on the environment or human health.

3. To demonstrate the economic viability of the technology by marketing Superwood products at a target price of $0.44 per pound, and resulting in a return of investment in five years or less.

4. To develop markets for Superwood over a 12 month period that would effectively guarantee the disposition of all Superwood products produced primarily from mixed plastic waste obtained from the city of Mississauga.

If the demonstration is successful, the technology will have wide application across Canada.This presents an opportunity for a profitable venture by a company that is part of Canada's environmental industry, while at the same time contributing to environmental, waste reduction, and energy conservation goals.

Project Schedule

Steps leading to the successful demonstration of the plastic recycling facility will include the following:

1. Establish a recycling facility for mixed plastic wastes from the Mississauga blue box curbside recycling program. This will include obtaining manufacturing and processing equipment, including a Superflow Jumbo Moulding machine with a rated extruder output of 200-250 kilograms per hour, and complying with all requirements of the Ontario Ministry of the Environment.

2. Optimize the operation of the facility with respect to feedstock preparation, operation of the extruder, and product quality, including the determination of the range of cross sections that can be successfully extruded, and the effects of different stabilizers and pigments.

3. In consultation with the Scientific Authority, design a program to test the physical characteristics of the product, such as tensile and compressive strength; deformation under heat and pressure; nail and screw-holding ability; susceptibility to weathering; resistance to ultraviolet light; resistance to acids, alkalis, solvents, and other chemicals; and dimensional stability.

4. Investigate product embellishment techniques such as special colour finishes, shaping, grain-like finishes built within the mould, improving the range of colours, and the preparation of assembly kits.

5. Report preparation. The report will clearly describe the level of success in achieving the objective of the project, as well as the environmental benefits, and resource and energy savings, that would be achieved if the technology were applied across Canada. It will include an economic analysis describing the financial viability of the technology, based on the results of the demonstration project. The party preparing the report, be it an employee of Superwood Ontario Ltd. or a third party, must be approved in advance by the Scientific Authority.

Data Collection and Analysis

Personnel from Superwood Ontario Ltd. will monitor the project; arrange for the collection and documentation of process information, including keeping a log of the operation of the

machine; and analyze the results of the project. The frequency and nature of the data to be collected will be determined by the contractor and approved by the Scientific Authority prior to start-up. The program to test the physical characteristics of the product, and the laboratory at which it will be conducted, will be approved in advance by the Scientific Authority.

Deliverables

The contractor shall deliver to the Scientific Authority at the place and time designated herein, the following:

Monthly Progress Reports:

The contractor shall prepare and submit monthly progress reports in three copies to the Scientific Authority and one copy to the Science Branch Contracting Officer.

Each progress report shall be in three parts:

Part 1: The following three questions MUST be answered:

1. Is the project on schedule?

2. Is the project on budget?

3. Is the project free of any areas of concern on which Crown assistance or guidance may be required?

   Each negative response must be supported with an explanation.

Part 2: A narrative report, brief, yet sufficiently detailed to enable the Scientific Authority to evaluate the progress of the work, containing as a minimum:

1. A description of the progress of each task and of the work as a whole during the period of the report. Sufficient sketches, diagrams, photographs, etc., shall be included, as necessary to describe the progress accomplished.

2. An explanation of any variation from the plan of work.

3. A description of trips or conferences connected with the contract during the period of the report.

4. A description of any major equipment items purchased or constructed during the period of the report.

Part 3: The Contract Plan and Report Form, DSS 9143-3, showing the following:

1. Actual and forecast expenditure on a monthly basis for the period of work being covered. (Expenditures are to be outlined by month and by task.)

2. Progress of the work against your original Contract Plan. (Instructions for showing the above on the Contract Plan are detailed in Appendix "C", attached.) The Contract Plan and Report Form will provide the basis for measuring the progress of the work, and the performance under this contract.

It is a requirement that these reports are in sufficient detail to allow the Scientific Authority to evaluate the success of the Contractor in completing applicable Milestones.

Milestone Report

One copy of a Milestone Report shall be delivered as follows:

Milestone 1: DUE DATE: 31 March 1990

Progress Report 1: Superflow Jumbo Moulding Machine with a rated capacity of 200-250 kg/hr, complete with all motors and controls, delivered.

Milestone 2: 31 August 1990

Progress Report 2: First report on technology demonstration, including product test results by independent testing laboratory.

Milestone 3: 31 March 1991

Final report and all remaining deliverables.

Draft Final Report

One copy prepared in accordance with Appendix "B", providing a discussion of the technical and environmental effectiveness of the demonstration project (including economic and energy savings benefits), and any other information required under the contract, must be delivered for review and approval by Environment Canada no later than 28 February 1991.

Final Report

Eleven copies, including one on magnetic medium (diskette), containing all reasonable changes requested by Environment Canada to the draft final report, must be delivered to, and accepted by, Environment Canada, no later than 31 March 1991.

Technology Transfer

In those areas within Canada where the Contractor has obtained, or will obtain, exclusive marketing rights for the technology from Superwood International Ltd., such technology will be made available by the Contractor at reasonable cost, to all interested parties.

The Contractor will obtain a written assurance from Superwood International Ltd. that in cases where marketing rights are granted to other persons or companies in Canada, such marketing rights will be made available at reasonable cost to all interested parties.

REPORT REQUIREMENTS FOR DRECT PROJECTS

General

An important goal of the DRECT program is to assist in the solving of national conservation problems. It is intended that the technology being demonstrated have wide application in Canada.

Although on the completion of the project, the developer will be given ownership of equipment, patents and detail designs, he must undertake to make any patents and technology developed available on reasonable terms to all interested parties in Canada.

On completion of the project, the contractor is to provide a detailed report outlining the process including costs, socio-economic improvements and other pertinent data relevant to the feasibility of the technology and its relevancy to the Canadian situation. It is this final report that might be considered the key element in the project since it is the sole instrument that will influence the increased use of the technology demonstrated including the main goal of the program.

It is suggested that the report cover the following list of subjects:

1. Define the objectives of the project.

2. Assess the success of the project in meeting this objective.

3. Describe the process in detail showing material and process flow design.

4. Provide an economic feasibility analysis of the process based on the results of the project.

5. Assess the applicability of the project to similar situations on a national basis.

6. Provide an enviromental and energy analysis of improvements or saving resulting from the project, (1) on an individual basis and (2) on the potential if installed on a national basis.

7. Provide a history of operating and maintenance data and problems for the reference of other potential users of the technology.

8. Provide a logistic and economic analysis of the waste(s) available or potentially available to which the new technology might be applied.

It is not intended that this list be complete or all inclusive. The main requirement is that a report be provided that will provide other potential users with sufficient information on the technology demonstrated such that a decision can be made on whether or not to proceed with similar installation in similar situations.

Consultants' Specifications for Environmental Protection Service Reports

The purpose of this specifications sheet is to ensure that final reports received from consultants require minimal change of format if published in the EPS Report Series. The Scientific Authority should be consulted on any questions.

Paper Size: All pages should be 216 mm x 279 mm (8 1/2" x 11").

Typing-Spacing: Spacing between each line of the text is one and a half spaces. Typing will preferably be done using 12 pitch 'Letter Gothic' type on a high-quality bond. Margins on both sides and at the bottom should be 25.4 mm (1"). The top margin should be 38.1 mm (1.5"). The page number should be centered down 25.4 mm (1") from the top of the page. Figures and Tables should have a least a 13 mm (0.5") margin.

Markings: No company identification should be included on original pages, illustrations, etc. Recognition of the consultant's efforts in doing the study should only appear in the authorship noted on the title page.

Exceptions: Format should follow that described in these specifications; if deviations are necessary, these should first be approved by the Scientific Authority.

Style of Writing: If the final report is not acceptable to the Scientific Authority in terms of understandability, quality and style of writing (and in terms of these specifications), it is incumbent on the contractor to rectify the report at his own expense.

Inclusions: Only material relevant to the topic at hand should be included. Contractual and administrative matters should not be described in final reports. Raw data, if voluminous, should be forwarded separately or, if necessary, included as an appendix.

Components: All original components (typed pages, original photos and drawings, etc.) belong to the Crown and are to be given to the Scientific Authority along with all copies of the final report.

Footnotes and References: Where possible, footnotes should not be used. It is acceptable to refer to literature cited by using brackets containing the author and the year of publication - e.g., (Jones, 1976), or using the numbered reference system where references are numbered consecutively as they appear in the text. References should be listed at the end of the report using the general format as below:

Books:	Author(s),	Title.	Publisher.	
	Location,	Chapter,	Page(s)	(Date).
Periodicals:	Author(s),	"Title",	Periodical,	
	Volume,	Issue.	Page.	(Date).

Information (e.g. internal reports, personal communications, etc.) which is not widely available should normally not be referenced. Furthermore, in those cases where applicable, the published versions of documents should be referenced and not the preliminary documents or drafts which preceded them.

Figures and tables should appear on a 216 mm x 279 mm page in a vertical position whenever possible. If figures and tables are derived from sources other than work in this study, these sources should be acknowledged on the figure or table.

Format: The sections of the report should include the following in the order given:

1. Title page (unnumbered)
2. Abstract (page i)
3. Resumé (French abstract) - leave blank; will be translated by EPS.
4. Foreword (page iii) (this is included only when necessary to explain briefly the background of the study)
5. Table of Contents (page v if Foreword is used, if not page iii)
6. List of Tables, List of Figures
7. Conclusions and Recommendations (if applicable)
8. Body of the report itself
9. References (if applicable)
10. Acknowledgements (if applicable)
11. Appendices (if applicable)

In the case of lengthy reports - i.e. over 100 pages or so - a separate summary report (10-15 pages) should also be submitted.

Structure and Numbering: All pages should be numbered sequentially starting from the first page of text (after the Table of Contents, etc.) to the end of the appendices, if these are present. Appendices are numbered alphabetically (e.g. A,B,C, etc.); however, their page numbers should follow on from those of the text. Tables of Contents, etc., for the appendices should be included with those of the main report. Figures and tables should also be numbered sequentially including those appearing in appendices. All sections of the report body should be numbered using the decimal system e.g., 3.5.8.1 (and if more than four subsections are required, the fifth is numbered using the lower-case alphabet and sixth level of division is numbered using Roman Numerals). Each numbered section should normally have a heading.

Figures, Tables, Plates: The term 'plates' (i.e., a photograph) should only be used if the report has a very large number of both photographs and line drawings; otherwise, both of these should be referred to as 'Figures'.

It is expected that all figures will be professionally drawn, clear, and understandable. Original copy or photoprints must be provided. Photographs should only be included to highlight or illustrate the subject of the text. Black and white glossies or negatives must be provided for any photograph used.

CONTRACT PLAN AND REPORT FORM

Instructions to Contractor

This form serves a dual purpose, the first is for planning and estimating the work, and the second is for reporting actual progress against the plan during contract execution.

PROPOSED PLAN

Your work and cost plan must be prepared on this "Contract Plan and Report Form" DSS MAS 9143-3 and must be submitted as part of your proposal. The plan shall demonstrate how you propose to execute the contract by subdividing the work into tasks and providing for each task an estimate of the cost and a schedule for completion. An example of a completed form is attached. (page I)

Use additional pages if the number of tasks exceed 15, or if the contract duration will exceed 12 months. For high value contracts in excess of $1M you are required to subdivide the work into major tasks which in turn are to be subdivided into minor tasks, e.g. a system is divided into subsystems which in turn are divided into subtasks, such as subsystem components.

You will be required to revise your plan to reflect the results of the contract negotiation. The revised plan will form part of contract.

REPORTING PROGRESS

Following contract award, monthly progress reports which record actual start dates and projected completion dates by task, actual cost by task, actual cost by month, Estimate to Complete (E.T.C.) by task and E.T.C. by month are to be prepared and submitted in accordance with the attached example, (page II), unless otherwise noted in the contract.

NOTE The contract file number, serial number and the actual months duration are to be entered in the appropriate blocks of the first and subsequent reports. The report period is to be indicated by drawing a solid vertical line at the end of the applicable month. Your progress report must be completed to the satisfaction of the Science Procurement Manager before progress claims will be processed for payment.

The following points concerning the attached example should be noted:

1) Reports actual progress to the end of August.

2) Actuals by month are recorded on the bottom line at the left of the date line and Estimate to Complete by month to the right of the date line.

3) MECHANICAL SUBSYSTEM Material Procurement started one month late, is projected to be completed on time, has cost $4M and the Estimate to Complete is $1M. Total subtask is expected to cost $5M.

4) MECHANICAL SUBSYSTEM Assembly is expected to start one month late and to be completed one month late. The expected late completions are to be highlighted using broken lines.

5) ELECTRICAL SUBSYSTEM Assembly started one month early and is expected to be completed one month early.

6) DISPLAY CONTROL SUBSYSTEM Procurement is 50% complete in terms of cost. The estimated completion date has slipped 2 months.

7) SYSTEM INTEGRATION AND SYSTEM TEST are both expected to start one month late reflecting the one month delay in MECHANICAL SUBSYSTEM Fabrication and Assembly.

8) As of the end of August, the total contract cost is expected to be $26M ($12.7M Actual plus $13.3M E.T.C.) or to equal the planned cost of $26M. The contract is expected to be completed one month later than planned.

FORMULE DE PROJET DE CONTRAT ET RAPPORT

Instructions aux entrepreneurs

Cette formule a un double but, elle sert premièrement à planifier et estimer le travail, et deuxièmement, à vérifier, tout au long de l'exécution du contrat, si les travaux se déroulent selon le plan.

PLAN PROPOSÉ

Les plans concernant les travaux et les coûts prévus doivent être établis sur la "Formule de projet de contrat et de rapport" DSS MAS 9143-3 et doivent être présentés comme faisant partie de votre proposition. Le plan doit faire état de la façon dont vous prévoyez mettre le contrat à exécution en divisant le travail en tâches et en donnant, pour chaque tâche, une estimation du coût et un calendrier d'exécution. Ci-joint à la page I un exemple de formule remplie.

Utilisez des pages additionnelles si le nombre de tâches dépasse 15 ou si la durée du contrat est de plus de douze mois. Pour les gros contrats d'une valeur supérieure à $1M, divisez le travail à accomplir en tâches principales que vous subdiviserez par la suite en tâches secondaires. Pensez, par exemple, à un système divisé en sous-systèmes, qui, à leur tour, sont subdivisés en sous-tâches, comme des composants du sous-système.

Vous devrez réviser votre plan pour tenir compte des résultats des négociations. le plan révisé fera partie du contrat.

RAPPORT DE SITUATION

Lorsqu'un contrat est adjugé, il faut remplir un rapport de situation mensuel indiquant la date à laquelle chaque tâche a été entreprise, ainsi que la date prévue d'achèvement de chaque tâche, la somme dépensée tous les mois pour chaque tâche et le coût prévu d'achèvement par tâche et par mois et présenter ce rapport de la façon indiquée à la page II ci-jointe à moins qu'il n'en soit indiqué autrement dans le contrat.

NOTA: Le numéro de dossier du contrat, le numéro de série et la durée actuelle en mois doivent être inscrits dans les cases correspondantes du premier rapport et des rapports subséquents. La fin de la période visée par le rapport doit être indiquée au moyen d'un trait vertical plein après le mois en question. Le rapport de situation doit être jugé satisfaisant par le directeur de l'approvisionnement scientifique avant que les demandes d'acompte ne soient traitées.

Soulignons les points suivants en ce qui concerne l'exemple annexé:

1) Les progrès, y compris ceux accomplis à la toute fin du mois d'août, figurent sur le rapport.

2) Les coûts réels, par mois, figurent en bas, à gauche du trait vertical plein indiquant la fin de la période visée par le rapport, le coût prévu pour l'exécution complète, en bas, à droite du trait vertical.

3) Ainsi, on voit que l'achat de matériel pour le sous-système mécanique a commencé un mois en retard, qu'on prévoit qu'il sera terminé à la date prévue. Cette tâche a coûté jusqu'ici $4M et on prévoit qu'elle coûtera un autre million d'ici à la fin des travaux. On prévoit donc qu'en tout, cette tâche aura coûté $5M.

4) L'assemblage du sous-système mécanique commencera probablement un mois en retard et se terminera aussi un mois en retard. Il faut mettre en relief les retards prévus au moyen de pointillés.

5) L'assemblage du sous-système électronique a débuté un mois en avance et devrait être terminé un mois en avance.

6) L'achat du sous-système de contrôle de l'affichage est exécuté à 50% en ce qui touche les coûts. La date prévue d'achèvement a toutefois été reportée de deux mois.

7) L'intégration et les vérifications du système devraient commencer deux mois en retard à cause du retard accusé au niveau de la fabrication et de l'assemblage du sous-système mécanique.

8) A la fin du mois d'août, on prévoit que le coût total du contrat sera de $26M ($12.7M déjà engagés et une dépense de $13.3M de prévue), c'est à dire qu'il atteindra le coût de $26M. La date d'achèvement a toutefois été reportée d'un mois.

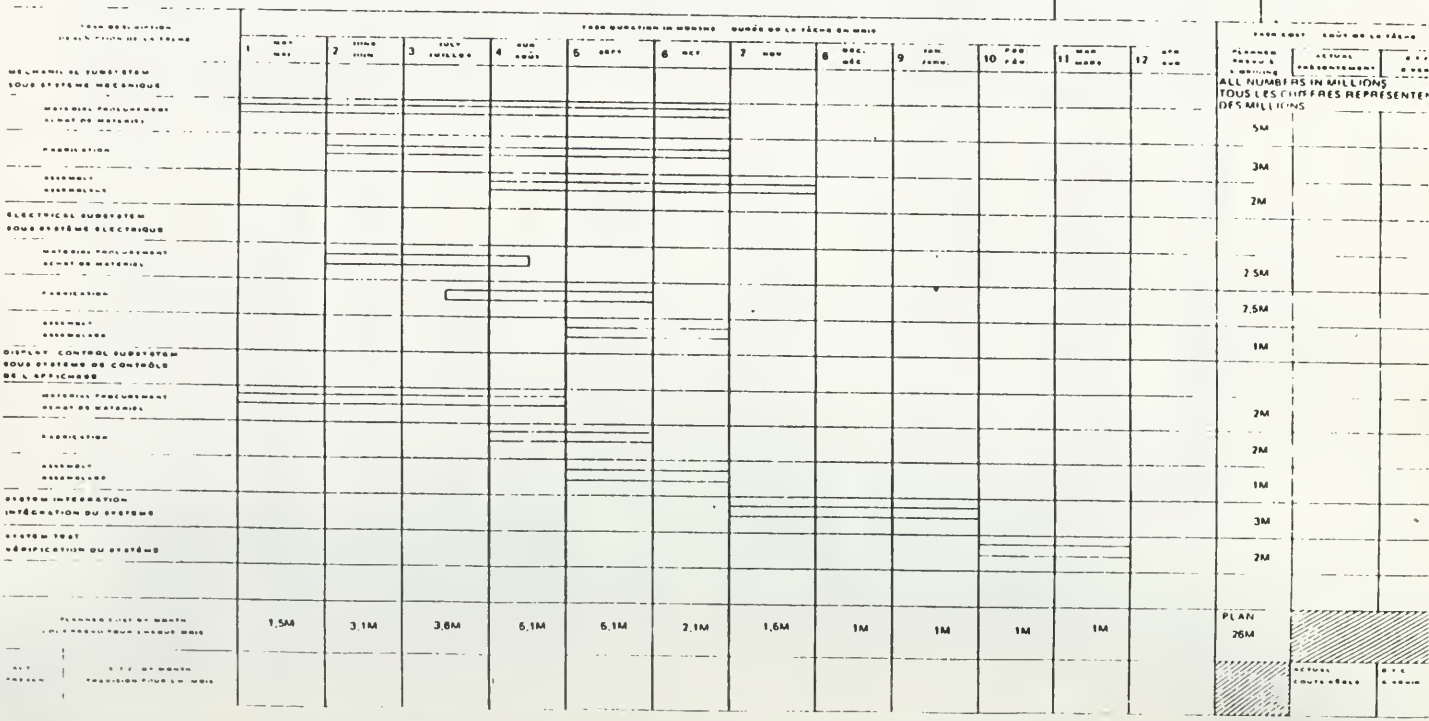
Supply and Services Canada | Approvisionnements et Services Canada

DSS MAS 9143-1 (4

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT GISMO DEVELOPMENT, ENGINEERING MODEL

CONTRACTOR – ENTREPRENEUR: ACME INDUSTRIES LTD.



Supply and Services Canada | Approvisionnements et Services Canada

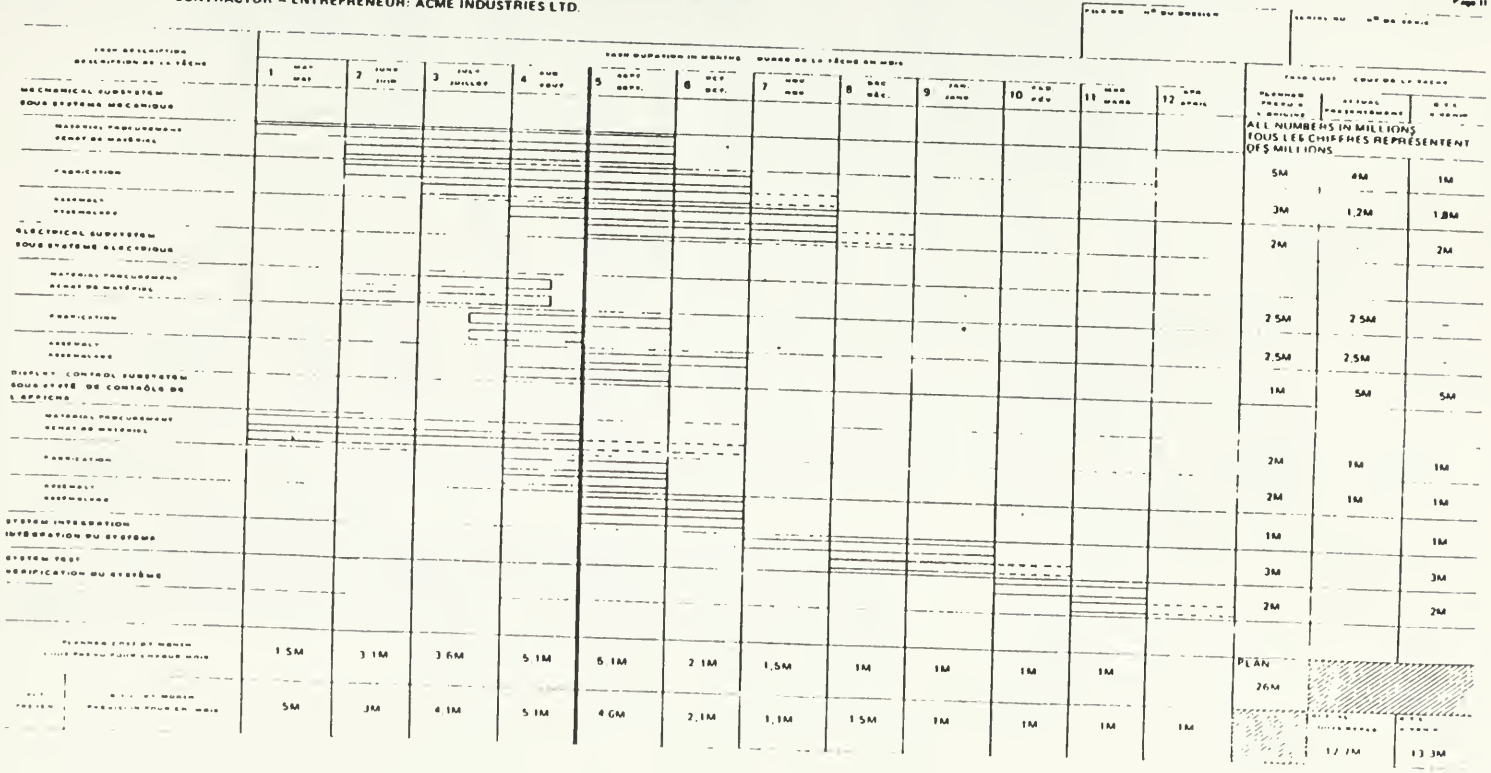
CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT: GISMO DEVELOPMENT, ENGINEERING MODEL

CONTRACTOR – ENTREPRENEUR: ACME INDUSTRIES LTD.

DSS MAS 9143 2 14/81

Page 11



Supply and Services Canada | Approvisionnements et Services Canada

DSS-MAS 9143 3 (4/81)

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT

CONTRACTOR – ENTREPRENEUR

FILE NO. – N° DU DOSSIER

SERIAL NO. – N° DE SÉRIE

TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1	2	3	4	5	6	7	8	9	10	11	12	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	ETC À VENIR
PLANNED COST BY MONTH COÛT PRÉVU POUR CHAQUE MOIS													PLAN		
ACTUAL PRÉSENT	ETC BY MONTH PRÉVISION POUR CE MOIS												ACTUAL Coûts réels		ETC À VENIR

APPENDIX D

DELIVERABLE ITEMS AND DOCUMENTS

	CONSIGNEE & QUANTITY		
	REQUIRED DELIVERY DATE	SCIENTIFIC AUTHORITY	PROCUREMENT OFFICER
Deliverable Items			
Progress Reports & Intellectual Property			
Monthly Progress Report	Monthly	3 copies	transmittal advice
Milestone Report #1	31 March 1990	1 copy	transmittal advice
Milestone Report #2	31 August 1990	1 copy	transmittal advice
Draft Final Report	28 February 1991	1 copy	transmittal advice
Final Report	31 March 1991	11 copies	transmittal advice
Other Documents			
Progress Claims/ Invoices	As indicated		1 original & 4 copies
Supporting Documentation for Above		1 copy	1 copy
Correspondence with Government Relating to this Arrangement		1 copy	1 copy

APPE JIX "E"

OUTLINE OF ELIGIBLE COSTS AND CHARGES

Establishment and Operation of Demonstration Facility

Manufacturing and processing equipment

Fork-Lift	$25,000		
Bobcat	25,000		
Superflow Jumbo Extruder	310,000		
Granulator	60,000		
Densifier	60,000		
Shredder	4,650		
Chiller	15,000		
Compressor	10,000		
Pallet Truck	375		
Air Conveyors (Gran)	3,000		
Air Conveyors (Mix)	1,500		
Air Lines	4,500		
Electrics	30,000		
Silos	13,500		
Mixer	12,000		
Electrical Spares	5,000		
Mechanical Spares	10,000		
Moulds	12,000		
Strapping Machine	1,500		
Racking	7,500		
Cooling Dollies	1,200		
Value Added Shop Tools	40,000		
Tool Kits	9,000	$660,725	
Labour		57,900	
Engineering and consulting services		13,000	
Product testing		5,000	
Overheads		6,000	$742,625
Report Production			20,000
TOTAL			$762,625